Montana Department of Health and Environmental Sciences
Water Quality Bureau
Cogswell Building
Helena, Montana 59620

MONTANA WATER QUALITY 1988

The 1988 Montana 305(b) Report
August 1988

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SUMMARY

INTRODUCTION

Section 305(b) of the federal Clean Water Act (Public Law 92-500) requires each state to submit a biennial report to the U.S. Environmental Protection Agency (EPA) describing the quality of its surface waters. Section 106(e)(1) of the act extends this reporting requirement to include ground water quality. This is Montana's 1988 305(b) Report to EPA.

BACKGROUND

Montana is a big, varied and sparsely settled state. Montana's major industries are agriculture, forest products, recreation and tourism, coal and metals mining, oil and gas production and hydropower. The state has relatively little in the way of manufacturing and heavy industry.

Precipitation falling on Montana drains to three oceans via three major river systems: The Clark Fork-Columbia, the Missouri-Mississippi, and the Saskatchewan-Nelson. Montana has 16 river basins, about 20,000 miles of streams, 750,000 acres of lakes (about 4,000 lakes), and an estimated 2,000,000 acres of wetlands.

Natural waters in Montana range in quality from the almost distilled water of some headwater lakes and streams in the west to waters exceeding the salinity of seawater in the eastern part of the state. The several classes of waters in the Montana Surface Water Quality Standards reflect the varied natural conditions of waters in the state.

SURFACE WATER QUALITY

Support of Designated Uses

Streams. About 80 percent of Montana's stream miles have been evaluated for water quality conditions and about 15 percent are monitored on a regular basis. Of the stream miles that have been evaluated and monitored, 63 percent fully support designated uses, 34 percent partially support designated uses, and 3 percent do not support designated uses.

Lakes. About 70 percent of Montana's lake acres have been evaluated for water quality conditions and about 17 percent are monitored on a regular basis. Of the lake acres that have been evaluated and monitored, 95 percent fully support designated uses, 3 percent partially support designated uses, and 2 percent do not support designated uses.

Nonsupport of Designated Uses

Streams. The major causes of less than full support of designated uses in Montana streams are siltation, nutrients, salinity, flow alteration, thermal modification, habitat alteration, and metals. The major sources of less than full support in Montana streams are agriculture, resource extraction, hydromodification, natural and unknown, forest practices and construction.

Lakes. The major causes of less than full support of designated uses in Montana lakes are habitat alteration, salinity, siltation and nutrients. The major sources of less than full support in Montana lakes are hydromodification and agriculture.

Public Health and Aquatic Life Concerns

Toxic contaminants. Three categories of toxic contaminants are a concern in Montana: heavy metals, chlorine and ammonia, and chlorinated hydrocarbons. About 890 miles of Montana streams and 9,100 acres of Montana lakes have elevated levels of toxics.

Nontoxic contaminants. Sediments, nutrients, stream dewatering for irrigation, and high water temperatures have been persistent problems in Montana, made worse by the severe drought and widespread fires of 1988. The natural intestinal parasite *Giardia lamblia* and the toxic blue-green alga *Anabaena flos-aquae* pose potential hazards to water users in Montana.

Lake Information

Eutrophic status. The eutrophic status of 1,469 Montana lakes is known. About 33 percent of these lakes are oligotrophic, 31 percent are mesotrophic, 27 percent are eutrophic and 9 percent are dystrophic.

Condition and trend. Five lakes totalling 21,500 acres have impaired uses because of their high salt content. Five additional lakes totalling 12,496 acres have uses impaired by other causes. There are no lakes in Montana that are known to be impacted by acid deposition or acid mine drainage. The data base for Montana lakes was developed so recently that it is not possible to ascertain trends in lake water quality. Although some lakes have elevated concentrations of toxics, none are known to have impaired uses as a result of toxic pollution.

Nonpoint Source Information

Nonpoint source information was reported earlier in the State of Montana Section 319 nonpoint source assessment report.

Waterbody-Specific Information

Waterbody-specific information is presented for one stream segment impaired by metals discharged from an industrial source, four stream segments impaired by ammonia and chlorine discharged by municipal wastewater treatment plants, and five segments impaired by nontoxic pollutants discharged by various point sources. These are the only stream segments known to be impaired by point sources of pollution. Waterbody-specific information for stream segments impaired by nonpoint sources of pollution is presented in the State of Montana Section 319 nonpoint source assessment report.

GROUND WATER QUALITY

Ground Water Occurrence and Use

General Setting. The distribution and quality of ground water resources in Montana are determined by topography, climate and geology. These features, hence ground water resources, are fairly uniform in each of the state's three physiographic provinces: Northern and Middle Rocky Mountains physiographic provinces and Great Plains physiographic province. Generally, aquifers in the Rocky Mountains provinces receive more recharge and produce larger volumes of better quality water than do aquifers in the Great Plains province.

Principal aquifers. Montana has ten principal aquifers, including five aquifers of Cenozoic age, four of Mesozoic age and one of Paleozoic age.

Ground water use. Ground water withdrawals constitute less than 2 percent of the total water withdrawals in Montana. However, about one-half of the state's population and nearly all of its rural population is supplied with water for domestic purposes from ground water sources.

Ground Water Protection

Montana has a number of industry-specific ground water pollution control programs as well as the umbrella Montana Ground Water Pollution Control System (MGWPCS) administered by the Department of Health and Environmental Sciences. Potential sources of ground water pollution that are regulated by industry-specific programs must still satisfy the MGWPCS nondegradation policy and meet ground water quality standards. The Department has agreements with several state agencies to assist in the review of permit applications and to insure that water quality concerns are thoroughly addressed. Pollution sources that are not permitted by other federally mandated or state permitting systems are required to obtain a MGWPCS permit.

Ground Water Contamination Problems

The principal sources of ground water contamination in Montana are underground storage tanks, spills, mineral processing, abandoned hazardous waste sites, septic tanks and agricultural activities. The principal substances which contaminate ground water in Montana are petroleum products, metals, cyanide, organic chemicals, nitrates and pesticides. Several cases of petroleum, cyanide, heavy metals and pesticides in ground water as well as 16 regulated waste sites and two emergency removal actions are described.

Ground Water Research

The main ground water research agencies in Montana are the Montana Bureau of Mines and Geology (MBMG) and the United States Geological Survey (USGS). Ground water investigations conducted by the Department of Health and Environmental Sciences are generally directed at documenting water quality violations. Current ground water research activities conducted or supported by each of these agencies are described.

WETLANDS

Little information is available regarding water quality in Montana wetlands. Elevated concentrations of salts, selenium and other trace elements and pesticides from agricultural and irrigation practices are the principal water quality concerns in Montana wetlands. Until completion of the National Wetlands Inventory in Montana, it will be impossible to measure how fast the state's wetlands are being lost to development and to assess the significance of those losses. Several government programs and initiatives to protect wetlands are described.

WATER POLLUTION CONTROL PROGRAMS

Programs of the Department of Health and Environmental Sciences are described. The Department is the primary agency responsible for administering and enforcing state and federal water pollution control and water supply laws.

Point Source Control Programs

Construction Grants Program. The 1987 amendments to the federal Clean Water Act initiated the transition from the Construction Grants Program to the new Revolving Loan Program. Construction of four wastewater treatment facilities to reduce phosphorus loads to Flathead Lake began in 1987. A new inspection program was begun in 1987 to evaluate grant-funded wastewater treatment facilities and their ability to meet effluent standards.

Pretreatment Program. The goal of the National Pretreatment Program is to protect municipal wastewater treatment plants and the environment from hazardous or toxic wastes that are discharged into sewage systems. The Montana EPA office is the lead agency for this program in Montana. Billings, Bozeman, Butte, Helena, Great Falls and Missoula have developed EPA-approved pretreatment programs.

Permits Program. The Montana Permits Program administers the Montana Pollutant Discharge Elimination System (MPDES), the Montana Surface Water Quality Standards (MSWQS), and the Montana Ground Water Pollution Control System (MGWPCS). The Department administers about 310 individual MPDES permits. About 225 additional authorizations are administered under the five general MPDES permits. Under MSWQS, complaints of water pollution are investigated and resolved; plans for short-term instream construction are reviewed and modified to reduce effects on water quality; and plans for leach pads, tailings ponds and ponds used in the processing of ore are reviewed to prevent water pollution. Starting in 1988, the Department is placing additional requirements in major MPDES permits for biomonitoring and sludge monitoring to control the discharge of toxic pollutants. Beginning in 1987, Department staff began using the EPA Permits Compliance System (PCS) to help handle the large amount of data generated by MPDES permittees. Special attention has been given to permittees in the Flathead Lake and Clark Fork River drainages because of documented nuisance algae and associated eutrophication problems.

Enforcement Program. During calendar years 1986 and 1987, the Department investigated 247 citizen complaints, requested formal enforcement action from the Department Legal Unit on 31 cases, issued 3 administrative enforcement orders, filed 22 civil complaints, and collected $45,750 in civil penalties and $8,884 in agency enforcement costs. A total of $27,050 in civil penalties was assessed but suspended by court order pending performance.

Nonpoint Source Control Program

Montana's nonpoint source control program was described earlier in the State of Montana Section 319 nonpoint source management plan.

Ground Water Protection Program

The Montana Ground Water Pollution Control System (MGWPCS) includes a ground water classification system, ground water quality standards, a non-degradation policy and a permit program. Most of the approximately 40 existing MGWPCS permit sites are gold leach operations or industrial nonhazardous waste storage and disposal facilities. The Department has emergency

authority to require the person responsible for a spill or accidental discharge to take immediate measures to remedy pollution problems, monitor impacts, and provide alternate supplies to existing ground water users affected by the release. The Department has formalized the joint review of potential sources of ground water pollution with other state agencies.

Surface Water Monitoring Program

Monitoring provides basic information for a number of water quality management functions. The Department's surface water monitoring program continues to focus on priority waterbodies and priority basins, namely the Clark Fork and the Flathead, using short-term, intensive and synoptic surveys as well as long-term, fixed-station and fixed-frequency monitoring. Biological sampling and bioassays using the crustacean *Ceriodaphnia* are used in most monitoring projects and intensive surveys. All water quality monitoring performed by the Department conforms to U.S. Environmental Protection Agency (EPA) quality assurance guidelines and all data are entered into EPA's water data management system (STORET). Several water quality monitoring projects, either conducted or supported by the Department, are described.

Special Programs

Two special programs -- the Flathead Basin Commission and the Clark Fork River Basin Project -- have been established to facilitate water quality management planning in Montana's two priority river basins. Functions and activities of these programs are described.

Drinking Water Program

The Department regulates about 2,329 public water supplies in Montana under authority of the federal Safe Drinking Water Act. Underground aquifers provide water to more than 95 percent of Montana's public water supplies but these sources serve only about 30 percent of the people who use public systems in Montana. Generally, Montana's ground water is not vulnerable to bacterial contamination and ground water systems have caused few health-related problems. Only about 4 percent of the state's public water supplies use surface water, but these systems provide water to about 70 percent of the people who receive water from public systems. The major concern is that many supplies have no treatment other than chlorination. These supplies may be "at risk" to outbreaks of giardiasis, a flu-like illness caused by the intestinal parasite *Giardia lamblia*. The Department has implemented a successful *Giardia* risk assessment program which has been copied by other states.

RECOMMENDATIONS

Several recommendations are presented for accomplishing the objectives of Montana's proposed nonpoint source pollution control program. Foremost among these recommendations is for Congress and the Executive Branch in Washington, D.C. to get serious about funding nonpoint source pollution control needs identified by the states and the federal resource management agencies.

1. INTRODUCTION

Section 305(b) of the federal Clean Water Act (Public Law 92-500) requires each state to submit a biennial report to the U.S. Environmental Protection Agency (EPA) describing the quality of its surface waters. Section 106(e)(1) of the act extends this reporting requirement to include ground water quality. This is Montana's 1988 305(b) Report to EPA.

State government has assumed primary responsibility for several key programs to protect and restore water quality in Montana. For these programs, the EPA serves in a capacity of oversight and technical support, and shares program expenses with the state. At this time of faltering economies and tightening budgets, both the state and EPA are attempting to better focus their limited resources on priority water quality problems and manage water quality programs for maximum environmental results. This report is intended to facilitate achievement of these objectives.

The 305(b) water quality assessment is the leading document in Montana for guiding water quality management decisions and for reporting on progress in dealing with problems the state is facing. EPA, both Region VIII in Denver and headquarters in Washington, D.C., uses the biennial 305(b) reports in many ways. EPA in turn is required to transmit these reports to Congress, along with an analysis of the quality of the nation's waters.

2. BACKGROUND

2.1 Atlas

Montana is a big, varied and sparsely settled state. While it ranks fourth in area among the states, it has less than one million people and the sixth smallest population. The varied topography supports near-desert, grassland, forest and alpine ecosystems. Precipitation falling on Montana drains to three oceans via three major river systems: the Clark Fork-Columbia, the Missouri-Mississippi, and the Saskatchewan-Nelson. Natural waters range in quality from the almost distilled water of some headwater lakes and streams in the west to waters exceeding the salinity of seawater in the eastern part of the state.

The following background information will give the reader some additional perspective for the assessment data contained in this report:

State population: 786,690 (1980 census)

State surface area: 147,045 square miles

Number of river basins: 16 basins

Total stream miles: 20,532 miles[1] (estimated)

Names and mileages of border rivers: none

Number and area of lakes, reservoirs and ponds: 4,018 lakes = 756,450 acres (estimated)

Area of wetlands = 2,000,000 acres (estimated)

Montana's major industries are agriculture, forest products, recreation and tourism, coal and metals mining, oil and gas production and hydropower. Agriculture in Montana is suffering serious drought and economic problems, as it is elsewhere. Similarly, low market values in recent years have severely curtailed oil exploration and production and the mining and processing of copper and other base metals. On the other hand, there has been a resurgence in mining of gold, silver and other precious metals. Timber harvest is shifting from private

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[1]This figure is based on the number of stream miles (19,505) in the Montana Department of Fish, Wildlife and Parks (DFWP) stream data base, which is estimated to be 95% of the stream miles in Montana that support fish. The number of stream miles classified under the Montana Surface Water Quality Standards is unknown, but is somewhat larger than the number of miles that support fish.

to public (mostly U.S. Forest Service) lands, where the projected harvest rate is accelerating. Meanwhile the recreational use of public lands and waters is increasing. Montana has relatively little in the way of manufacturing and heavy industry.

2.2 Summary of Classified Uses

The several classes of waters in the Montana Surface Water Quality Standards reflect the varied natural conditions in the state (Table 2-1 and Figure 2-1). The official status of a few streams (classified as "I" in the Standards) reflects the near-permanent damage caused by resource exploitation in Montana's past.

Table 2-2 presents total stream miles and lake acres classified according to the various uses prescribed in the Montana Surface Water Quality Standards. Although waters on Indian Reservations were declassified in the latest (1988) revision of the Standards, they are included in the classified use totals in Table 2-2. The size of these waters is unknown.

Table 2-1. Water-use descriptions for different water classifications in Montana. Source: Montana Surface Water Quality Standards, Administrative Rules of Montana (ARM), Title 16, Chapter 20. (See also Figure 2-1).

16.20.616 A-CLOSED CLASSIFICATION: (1) Waters Classified A-Closed are suitable for drinking, culinary and food processing purposes after simple disinfection.

16.20.617 A-1 CLASSIFICATION: (1) Waters classified A-1 are suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities.

16.20.618 B-1 CLASSIFICATION: (1) Waters classified B-1 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

16.20.619 B-2 CLASSIFICATION: Waters classified B-2 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

16.20.620 B-3 CLASSIFICATION: (1) Waters classified B-3 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

16.20.621 C-1 CLASSIFICATION: Waters classified C-1 are suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

16.20.622 C-2 CLASSIFICATION: (1) Waters classified C-2 are suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

16.20.624 C-3 CLASSIFICATION: (1) Waters classified C-3 are suitable for bathing, swimming and recreation, growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers. The quality of these waters is naturally marginal for drinking, culinary and food processing purposes, agriculture and industrial water supply. Degradation which will impact established beneficial uses will not be allowed.

16.20.623 I CLASSIFICATION: (1) The goal of the state of Montana is to have these waters fully support the following uses: drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Table 2-2. Total stream miles and lake acres in Montana classified according to the various uses prescribed in the Montana Surface Water Quality Standards.

Classified Use	Total Size Classified for Use	
	Streams (Miles)	Lakes (Acres)
Aquatic Fish & Wildlife	20,532 [a]	756,450
Domestic Water Supply	20,486 [b]	756,450
Recreation	20,532 [a]	756,450
Agriculture	20,532	756,450
Industrial	20,532	756,450
Navigation	0 [c]	0 [c]
Nondegradation	Unknown [d]	Unknown [d]
Unclassified	Unknown [e]	Unknown [e]

a Includes 58 miles of "I" streams where this use is a goal.

b Excludes 46 miles of streams classed C-1 and C-2, which are not considered suitable for drinking, culinary and food processing purposes; includes 58 miles of "I" streams where domestic water supply is a goal but not an existing use.

c Although several definitions of navigable waters exist, no waters are so classified in the Montana water quality standards.

d Montana's nondegradation rule applies to all surface waters where quality is higher than established water quality standards; degradation of national resource waters (surface waters in national parks, wilderness and primitive areas) is prohibited; the size of these waters is unknown.

e Waters used solely for treating, transporting or impounding pollutants are not classified; the size of these waters is unknown.


MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
Environmental Sciences Division
Water Quality Bureau
WATER USE CLASSIFICATIONS
as listed in the
SURFACE WATER QUALITY STANDARDS
LEGEND
A-Closed
A-1
B-1
B-2
B-3
C-1
C-2
C-3
I
DRAINAGE BASIN BOUNDARY
KOOTENAI
RIVER
Flathead Lake
FLATHEAD
CLARK
FORK
MISSOULA
Blackfoot
River
Clark Fork
BITTERROOT
Hamilton
Georgetown Lake
BUTTE
HELENA
Canyon Ferry Lake
MISSOURI
RIVER
Smith
Judith
Musselshell
GREAT FALLS
Teton
Sun
Marias
Milk
Fort Peck Reservoir
Jefferson
Big Hole
Beaverhead
Dillon
Clark Canyon Reservoir
Red Rock Lakes
Madison
Gallatin
Ruby
YELLOWSTONE
BILLINGS
Livingston
Stillwater
BIGHORN
Tongue
POWDER
Miles City
Glendive
Sidney

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Figure 2-1

3. SURFACE WATER QUALITY

A comprehensive assessment of surface waters is essential as the basis for planning and conducting water quality management programs. The purpose of this assessment is to direct water quality management activities to where they will be the most effective and to track progress in correcting and preventing water quality problems. The sections that follow assess the quality of Montana's lakes and streams from a number of perspectives using a variety of yardsticks.

3.1 Method

Information about the quality of the state's surface waters is derived from three sources:

1. Fixed-station ambient monitoring conducted principally by the U.S. Geological Survey, Water Resources Division and the Montana Department of Health and Environmental Sciences, Water Quality Bureau;

2. Intensive surveys conducted by the Water Quality Bureau and others; and

3. Fish biologists, hydrologists, and other land and waters resource management specialists statewide.

Data gathered by the state in the course of fixed-station monitoring and intensive surveys are entered into the Montana water quality data management system and, along with data collected by the USGS and other agencies, into STORET. These data are evaluated by state water quality specialists, who judge the ability of the represented waters to meet water quality standards and to support beneficial uses. Such judgments are generally based on a comparison of ambient data with a variety of chemical, biological and physical habitat criteria. No single formula or index is used. These judgments have been combined with those made by other land managers and water quality professionals statewide (e.g., those solicited in the 1984 non-point source survey sponsored by ASIWPCA) to form the basis of the following assessment.

3.2 Support of Designated Uses

Tables 3-1 and 3-2 summarize the degree of support of designated uses in Montana streams and lakes, respectively.

Miles of streams and acres of lakes <u>assessed</u> are those for which there is information in the Department of Fish, Wildlife and Parks stream and lake data bases. Miles of streams and acres of lakes <u>monitored</u> are those for which water quality data are currently collected at fixed stations on a regular schedule.

Table 3-1. Support of designated uses in Montana streams.

Degree of Use Support	Assessment Basis: Evaluated	Assessment Basis: Monitored	Total Assessed
Miles Fully Supporting	11,957	304 [e]	12,261
Miles Threatened [a]	55 [d]	304 [e]	359
Miles Partially Supporting [b]	3,944	2,686	6,630
Miles Not Supporting [c]	588	26 [f]	614
TOTAL	16,489	3,016	19,505

a Miles threatened is a subset of miles fully supporting.
b Equivalent to miles suffering moderate impairment.
c Equivalent to miles suffering severe impairment.
d Musselshell River (Headwaters to Deadman's Diversion).
e Sections of the Flathead, Kootenai and Tongue Rivers.
f Silver Bow Creek.

Table 3-2. Support of designated uses in Montana lakes.

Degree of Use Support	Assessment Basis: Evaluated	Assessment Basis: Monitored	Total Assessed
Acres Fully supporting	503,367	126,000 [e]	629,367
Acres Threatened [a]	3,500 [d]	126,000 [e]	129,500
Acres Partially Supporting [b]	21,396	0	21,396
Acres Not Supporting [c]	12,600	0	12,600
TOTAL	537,363	126,000 [e]	663,363

a Acres threatened is a subset of acres fully supporting.
b Equivalent to acres suffering moderate impairment.
c Equivalent to acres suffering severe impairment.
d Whitefish Lake.
e Flathead Lake.

This is a subset of miles and acres assessed. Miles of streams and acres of lakes evaluated are those for which water quality information has been collected by a means other than fixed-station monitoring. This is also a subset of miles and acres assessed.

Miles and acres fully supporting designated uses are those for which, in the judgement of water quality professionals, there are no water quality factors that are restricting water uses below the potentials for those sites. Miles and acres threatened are those where uses are currently fully supported but where projected land uses and development portend declining water quality. Miles and acres partially supporting are those where all uses are supported to some degree but one or more uses are not supported up to the potential for those sites. Miles and acres not supporting are those where one or more of the designated uses (usually fish production) is totally unsupported.

Tables 3-3 and 3-4 summarize attainment of the fishable and swimmable goals of the federal Clean Water Act. The swimmable goal is presently met in all of Montana's surface waters for which assessment information is available. Only a small percentage of the state's lakes and streams do not meet the fishable goal. This is due to high salinity in three lakes and toxic metals in about four dozen stream segments. A goal is not attainable if standards are less stringent than the goal, based on an EPA-approved use attainability analysis. The state has not conducted use attainability studies on these lakes and streams.

Table 3-3. Attainment of Clean Water Act goals in Montana streams.

Goal Attainment	Fishable Goal	Swimmable Goal
Miles meeting	18,891	19,505
Miles not meeting	614	0
Miles not attainable	0 [a]	0
Miles unknown	1,027	1,027

a All Montana streams are classified as fishable and swimmable. However, some streams are so severely polluted with historic mining wastes that it may never be practical to restore them to fishable status. The state has not conducted use attainability studies on these streams.

Table 3-4. Attainment of Clean Water Act goals in Montana lakes.

Goal Attainment	Fishable Goal	Swimmable Goal
Acres meeting	650,763	663,363
Acres not meeting	12,600 [a]	0
Acres not attainable	0 [b]	0
Acres unknown	93,087	93,087

a Lakes Benton, Bowdoin and Freezeout.

b All Montana lakes are classified as fishable and swimmable. However, three lakes -- Benton, Bowdoin and Freezeout -- are so severely polluted with salts from natural and agricultural sources that they may never support a fishery. The State has not conducted use attainability studies on these lakes.

3.3 Nonsupport of Designated Uses

The following sections summarize the causes (pollutants) and sources of nonsupport for those waters in tables 3-1 and 3-2 that do not fully support their designated uses. In the tables that follow, severe impact is equivalent to complete nonsupport and moderate impact is equivalent to partial support.

3.3.1 Causes of Nonsupport

Tables 3-5 and 3-6 list the miles of streams and acres of lakes impaired by various pollutants. Sediments, salts, nutrients and flow alteration are the leading causes of nonsupport in streams. Habitat alteration, due primarily to fluctuating water levels in hydroelectric impoundments, is the leading cause of nonsupport in lakes. In streams, severe impact (total nonsupport) is most commonly caused by pH, sediment, nutrients and metals. In lakes, severe impact is most commonly caused by sediment, salts, nutrients and bacteria.

3.3.2 Sources of Nonsupport

Tables 3-7 and 3-8 list the miles of streams and acres of lakes impaired by various source categories.

Agriculture is the leading source of nonsupport in Montana streams, in part because of the relatively large land area dedicated to this activity statewide. Other leading causes of nonsupport in streams are resource extraction, hydromodification, natural and unknown, forest practices and construction. Point sources account for only a small percentage of impacted stream miles. Severe impact (total nonsupport) most frequently results from agricultural practices, resource extraction, and hydromodification.

Hydromodification is the leading source of nonsupport in lakes. Severe impact (total nonsupport) in lakes most commonly results from agricultural practices. Point sources are not known to result in use impairment in any Montana lakes.

Table 3-5. Miles of streams not fully supporting uses affected by various cause categories.[a]

CAUSE CATEGORY	SEVERE IMPACT	MODERATE IMPACT
Unknown toxicity	0	0
Pesticides	0	0
Priority organics	23	0
Nonpriority organics	0	0
Metals	284	606
Ammonia	43	24
Chlorine	36	0
Other inorganics (arsenic, cyanide)	0.5	243
Nutrients	310	2,895
pH	614	97
Siltation	394	6,441
Organic enrichment/DO	22	92
Salinity	140	2,981
Thermal modification	213	1,441
Flow alteration	231	2,312
Habitat alteration	0	1,510
Pathogens	79	410
Radiation	0	2
Oil and grease	0	64
Gases	0	144

a Many stream reaches are affected by more than one cause; stream miles in these reaches are listed for each appropriate cause category.

Table 3-6. Acres of lakes not fully supporting uses affected by various cause categories. [a]

CAUSE CATEGORY	SEVERE IMPACT	MODERATE IMPACT
Nutrients	5,750	17,449
Siltation	19,022	5,600
Salinity	13,250	14,509
Thermal modification	0	2,513
Habitat alteration	0	284,000
Pathogens	1,423	1,300
Selenium	0	9,750

a Some lakes are affected by more than one cause; lake acres in these lakes are listed for each appropriate cause category.

Table 3-7. Miles of streams not fully supporting uses affected by various source categories. [a]

SOURCE CATEGORY	SEVERE IMPACT	MODERATE IMPACT
Point Sources		
Industrial	0	233
Municipal	43	118
Nonpoint Sources		
Agriculture	420	5,603
Forest practices	44	806
Construction	5	762
Urban runoff	27	61
Resource extraction	319	1,385
Land disposal	22	154
Hydromodification	171	1,299
Natural and unknown	32	1,097

[a] Many stream reaches are affected by more than one source; stream miles in these reaches are listed for each appropriate source category.

Table 3-8. Acres of lakes not fully supporting uses affected by various source categories. [a]

SOURCE CATEGORY	SEVERE IMPACT	MODERATE IMPACT
Point Sources		
Industrial	0	0
Municipal	0	0
Nonpoint Sources		
Agriculture	12,600	18,322
Forest practices	0	3,200
Resource extraction	0	2,100
Land disposal	150	5,420
Hydromodification	0	284,000

[a] Some lakes are affected by more than one source; lake acres in these lakes are listed for each appropriate source category.

3.4 Public Health/Aquatic Life Concerns

Achieving "fishable/swimmable" status for waters in Montana requires an analysis of pollutants that threaten aquatic life and public health. The following sections summarize what is known about how toxic and nontoxic contaminants threaten public health and limit recreation on Montana's waters.

3.4.1 Toxic Contaminants

Toxic pollutants are a growing concern throughout the country. Fortunately, Montana has little of the dense population, intensive agriculture and heavy industry that has resulted in serious toxics problems in other states. Table 3-9 summarizes the extent of the toxics problem in Montana.

Concern in Montana is focused on three groups of toxics: heavy metals, chlorine and ammonia from municipal wastewater discharges, and chlorinated hydrocarbons, including PCBs, and PCPs (polychlorinated biphenyls and pentachlorophenol). All three have been shown to be a problem in Montana surface waters. (See also Section 4.2. Ground Water Quality Problems.)

Approximately 700 miles of Montana rivers and creeks in 48 stream segments regularly experience concentrations of heavy metals that exceed EPA criteria for the protection of aquatic life. Biological surveys have documented a reduction in the number and diversity of aquatic plants or animals in 10 segments covering 300 miles. Abandoned or inactive hardrock metals mines are sources for almost all of this pollution.

Only one fish consumption advisory has been issued in Montana (1984), and that was because of elevated levels of mercury in trout in the upper reaches of Silver Creek near Helena below mining operations in the Marysville District. In older and larger fish, mercury sometimes exceeds the Food and Drug Administration (FDA) action level (1 mg Hg/g) in the edible flesh of fish taken from Nelson, Tongue River, Yellowtail and Fort Peck reservoirs in eastern Montana and from Fred Burr Creek near Philipsburg in western Montana. Fred Burr Creek is in an historic mining district; the source(s) of mercury at the other locations is unknown.

Freezeout Lake Game Management Area and Benton Lake National Wildlife Refuge had sampling sites where concentrations of toxic constituents in water, bottom sediment, and biota were moderately to considerably larger than established criteria and standards. The largest selenium concentrations in water and bottom sediment were from seeps that surround Benton Lake, with maximum concentrations of 580 micrograms per liter in water and 6.7 micrograms per gram in bottom sediment. Selenium was

detected in most biological samples. Several eared-grebe livers from Freezeout Lake and several coot livers and eggs from Benton Lake had selenium concentrations indicative of contamination.

Table 3-9. Total size of Montana surface waters affected by toxics.

WATERBODY	SIZE MONITORED FOR TOXICS	SIZE WITH ELEVATED LEVELS OF TOXICS
Streams (miles)	400 [a]	890
Lakes (acres)	0	9,100 [b]
Wetlands (acres)	0	unknown

[a] Approximate stream miles monitored by the Clark Fork River Basin Monitoring Project, DHES.

[b] Benton Lake and Freezeout Lake

Samples for analysis of chlorinated hydrocarbons in fish have been collected in recent years from a large number of waters in Montana, including Flathead Lake, Silver Bow Creek, Big Spring Creek, and the Clark Fork, Missouri, Madison, Marias, Bighorn and Boulder rivers. Most of the chlorinated hydrocarbons were present at concentrations below analytical detection limits. When residues were detected, the concentrations were very low and below existing guidelines for human consumption. Sources of chlorinated hydrocarbons in Montana include pesticides, wood treatment plants and electrical equipment. Known instances of surface water contamination by chlorinated hydrocarbons have been of limited scope and severity.

There have been no known incidences of fish found with tumors, lesions, disease or other abnormalities resulting from toxics in water, nor have swimming areas had to be closed because of toxics other than toxic algae. Toxic, metals-bearing sediments are a concern at most abandoned mine sites and particularly in the Clark Fork River where they have accumulated behind hydroelectric dams, e.g. Milltown dam near Missoula. Arsenic from these sediments contaminated the Milltown community water supply until the source was changed and the system was replaced by a Superfund cleanup action. An increase in gold mining and extraction operations has increased the threat of

water contamination by cyanide solutions used in the extraction ("heap leaching") process.

Montana has four stream segments where toxic ammonia or toxic ammonia and chlorine from municipal wastewater discharges are a problem. These are Prickly Pear Creek below the Helena WWTP (ammonia) Silver Bow Creek below the Butte WWTP (ammonia and chlorine), Ashley Creek below the Kalispell WWTP (ammonia and chlorine) and Hot Springs Creek below the Hot Springs WWTP (ammonia and chlorine). Four additional segments have suspected problems from ammonia toxicity: Milk River below the Glasgow WWTP, Matt Creek below the St. Ignatius WWTP, Crow Creek below the Ronan WWTP, and the Beaverhead River below the Dillon WWTP.

Table 3-10 presents information on fish kills reported to the Department of Fish, Wildlife and Parks (DFWP) since 1979. Only fish kills where the confirmed or suspected cause is toxics are reported here; fish kills from natural conditions (e.g., winterkill) are not included. DFWP records prior to 1983 are incomplete.

3.4.2 Nontoxic Contaminants

Among the conventional pollutants, sediments from agriculture, mining, forest practices and highway construction pose the largest problem for aquatic life in Montana waters. The fires that swept western Montana and northwestern Wyoming during the summer of 1988 have the potential to create or exacerbate sediment problems in many headwater drainages, some of them located in national park and wilderness areas and until now of pristine character.

Algal nutrients, particularly nitrogen and phosphorus, are a concern in Flathead and Whitefish lakes and in the Clark Fork River drainage feeding Lake Pend Oreille in Idaho. Unnaturally high summertime temperatures are a problem wherever streams are excessively dewatered by irrigation withdrawals. Critically low dissolved oxygen concentrations are a problem in Ashley Creek below the Kalispell wastewater treatment plant, but in few other streams in Montana.

There have been no incidents of waterborne disease or closures of surface drinking water supplies due to nontoxics in Montana in the last two years. (See Section 6.6 for information on Giardia.) Because of repeated blooms of toxic algae (Anabaena flos-aquae) that have killed a number of head of livestock, the shoreline of Hebgen Reservoir has been posted with warning signs in the summers of 1985, 1986, 1987 and 1988. Schistosome cercarial dermatitis ("swimmers' itch") is a recurring problem in Flathead Lake, where it has intensified over the last 10 years.

Table 3-10. Fish kills reported to the Department of Fish, Wildlife and Parks.

Year	Month	Location	Game Species Affected	Estimated Mortality	Cause
1979	July	Mill Creek (near Sheridan	trout	40-50	Acrolein leaking from an irrigation flume.
	September	Billman Creek (near Livingston)	trout	----	Unknown, herbicide suspected.
	July	Beaverhead River (near Dillon)	trout, whitefish	4,800	Acrolein entering from an irrigation ditch.
	July	Mill Creek (near Missoula)	trout, whitefish	280	Xylene leaking from an irrigation flume
	July	Blacktail Creek (near Dillon)	trout	40-50	Acrolein entering from an irriga- ditch.
1983	June	Boulder River (near Boulder)	trout	Less than 20	Unverified; metals originating from mine tailings suspected.
	July	Clark Fork River (near Galen)	trout, whitefish	500-1,000	Unverified; metals originating from mine tailings suspected.
	July	Racetrack Creek (near Racetrack)	trout	250	Acrolein leaking from an irrigation flume.
	September	Big Spring Creek (near Lewistown)	trout	1,000-1,500	Univerified; suspected discharge of anhydrous ammonia.
1984	June	Divide Creek (near Divide)	trout	Less than 50	Univerified; roadside herbicide suspected.
	July	Big Horn River (near Fort Smith)	trout	1,000-2,000	Unverified; suspected aquatic herbicide.
	July	Tributary to Big Muddy Creek (near Greenfield)	trout	Less than 50	Acrolein applied to an irrigation ditch.

Table 3-10. Continued.

Year	Month	Location	Game Species Affected	Estimated Mortality	Cause
1984	August	Clark Fork River (near Warm Springs)	trout, whitefish	More than 10,000	Metals leached from mine tailings during a thunderstorm.
	August	Boulder River (near Basin)	whitefish	50	Metals leached from mine tailings during a thunderstorm.
	October	Musselshell River (near Ryegate)	nongame only	----	Breached sewage oxidation lagoon.
	November	Figgins Creek (near Bozeman)	trout	50	Unverified; pesticides suspected.
1985	May	Warm Springs Creek (near Manhattan)	trout	----	Organic discharge from a dairy.
	June	Figgins Spring Creek (near Bozeman)	trout	----	Pesticide suspected.
	July	Camp Creek (near Amsterdam)	trout	25-50	Roadside herbicide suspected.
	September	Kootenai River (below Libby Dam)	kokanee, whitefish	500	Temperature shock resulting from a change in dam operation.
	September	Ten-Mile Creek (near Rimini)	trout	250-300	Thunderstorm on mine tailings suspected.
1986	July	Ruby River (near Ruby Reservoir)	trout	90-100	Acrolein leaking from an irrigation ditch.
1987	June	Clark Fork River (near Lost Creek)	trout	50	Metals leached from mine tailings during a thunderstorm suspected.

Table 3-10. Continued.

Year	Month	Location	Game Species Affected	Estimated Mortality	Cause
1987	July	Clark Fork River (near Warm Springs)	trout, whitefish	2,000-3000	Metals leached from mine tailings during a thunderstorm.
	July	Vandalia Ditch (near Glasgow)	northern pike	----	Ditch treated with acrolein.
1988	May	Spring Creek (near Choteau)	trout	30-50	Chlorinated discharge from a municipality.
	May	Mill-Willow Bypass (near Warm Springs)	trout	10-20	Metals leached from mine tailings during a thunderstorm.
	June	Racetrack Creek (near Galen)	trout	150-200	Acrolein leaking from an irrigation flume.
	June	Tenmile Creek (near Helena)	trout	50-100	Unaffirmed, pesticide suspected.
	July	Threemile Creek (near Corvallis)	trout	20-50	Xylene entering from an irrigation return.

3.5 Lake Information

The principal source of information on lakes in Montana is the Lake Data Base of the Department of Fish, Wildlife and Parks.

3.5.1 Eutrophic Status

Appendix A lists the eutrophic status of 1469 lakes as determined subjectively by regional fisheries biologists of the Montana Department of Fish, Wildlife and Parks. Insufficient information exists to determine the eutrophic status of the other 519 lakes in our data base.

The definitions used to make these determinations are:

O - Oligotrophic Lake: Nutrient poor, oxygen rich, depth usually greater than 15 feet, bottom material mostly inorganic, dissolved oxygen plentiful at bottom, emergent aquatic plants absent, total dissolved solids less than 30 ppm, plankton scarce.

M - Mesotrophic Lake: Attributes intermediate between those for oligotrophic and eutrophic lakes, depth usually greater than 20 feet.

E - Eutrophic Lake: Usually 10 to 25 feet deep, bottom material mostly organic, dissolved oxygen often absent at bottom, emergent aquatic plants present, total dissolved solids more than 30 ppm, plankton abundant.

D - Dystrophic Lake: Includes bog lakes, depth less than 20 feet, characterized by incomplete decay of plants, accumulation of humic materials, bottom material entirely organic, water saturated with dissolved oxygen during daylight hours, below saturation at night, emergent aquatic plants and plankton abundant.

Classification of lakes using these definitions could result in lakes being placed in different classes depending on the importance given to the various factors in the definitions. Because this is the first classification of many of these lakes it is not possible to assess trends in their eutrophic state. Other lakes have been classified for some time but no reassessment has been made.

3.5.2 Condition and Trend

The lakes and reservoirs listed in Tables 3-11 and 3-12 have impaired uses. This impairment is partially natural in many causes but has probably been exacerbated by nonpoint sources of pollution.

Table 3-11. Lakes and reservoirs with impaired uses because of their high salt content.

Lake Name	County	Acres	Severity
Benton Lake	Cascade	5,600	S
Freezeout Lake	Teton	3,500	S
Lake Bowdoin	Phillips	3,500	S
Medicine Lake	Sheridan	8,600	M
Priest Butte Lakes	Teton	300	M

Table 3-12. Lakes and reservoirs with uses impaired by low dissolved oxygen concentration, lack of fish spawning sites, shallowness, or excessive temperature.

Lake Name	County	Acres	Severity
Echo Lake	Flathead	546	M
Fresno Reservoir	Hill	4,000	M
Lake Francis	Pondera	5,536	M
Lake Helena	Lewis & Clark	2,100	M
Lebo Lake	Wheatland	314	M

At the present time there are no lakes in Montana which are known to be impacted by acid deposition or acid mine drainage. The data base for our lakes was developed so recently that it is not possible to identify trends in lake water quality. To date we have not identified any lakes which have impaired uses as a result of toxic pollution.

3.6 Nonpoint Source Information

The State of Montana Section 319 nonpoint source assessment report identifies:

1. Waterbodies that, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain water quality standards; and

2. Categories and subcategories of nonpoint sources or, where appropriate, particular nonpoint sources which add significant pollution to each waterbody listed above in amounts which contribute to not meeting water quality standards.

Several copies of the Montana nonpoint source assessment report were transmitted to EPA on August 4, 1988.

3.7 Waterbody-specific Information

Montana has not completed the development of records for its Waterbody System (WBS). Hence the state is not prepared to present waterbody-specific information for all waters that have been assessed. However, the state does have such information where assessments indicate that one or more uses have been impaired. For stream segments impaired by pollution originating from nonpoint sources, waterbody-specific information is given in Montana's Section 319 assessment report. For stream segments impaired by pollution originating from point sources, waterbody specific information is given in Table 3-13. For waterbody-specific information on Montana lakes, see Appendix A and section 3.5.2 of this chapter.

Montana's preliminary 304(l) Short List and Chlorine, Ammonia or Whole Effluent Toxicity List are presented in Table 3-13. The stream segments in Table 3-13, together with the lakes in section 3.5.2 and the waterbodies in the state's Section 319 assessment report constitute Montana's section 304(l) long list.

Table 3-13. Waterbody-specific information for stream segments impaired by pollution originating from point sources.

Stream Segment	Length (miles)	Impaired Uses [a]	Sources	Causes	Severity [b]	Method [c]
Section 304(l) Short List						
Silver Bow Cr. (Mill-Willow Bypass to Warm Springs Cr.)	6	A(C)	Anaconda Company Pond 2 Discharge	Copper, Zinc	M	M
Section 304(l) Chlorine, Ammonia or Whole Effluent Toxicity List						
Prickly Pear Cr.	6	A(C),D,R	Helena WWTP	Ammonia	S	E
Silver Bow Cr.	23	A(C),D,R	Butte WWTP	Ammonia Chlorine	S	M
Ashley Cr.	7	A(C),D,R	Kalispell WWTP	Ammonia Chlorine	S	E
Hot Springs Cr.	7	A(C),D,R	Hot Springs WWTP	Ammonia Chlorine	S	E
Impairment by Nontoxics						
Ashley Cr.	7	A(C),R	Kalispell WWTP	Nutrients Organics/DO	S	E
Powder River	218	I,D	Petroleum production water discharges in Wyoming	Salts	M	E
Clark Fork R.	16	A(C),R	Missoula WWTP	Nutrients	M	M
Clark Fork R.	9	A(C),R	Stone Container Corp.	Nutrients Color	M	M
Clark Fork R. (Warm Springs Cr. to Rock Cr.)	102	A(C),R	Several WWTPs	Nutrients	M	M

[a] A(C) = Aquatic life (cold water); D = Domestic water supply; I = Irrigation; R = Recreation

[b] M = Moderate (uses partially supported)
S = Severe (uses totally unsupported)

[c] M = Monitored (fixed-station sampling on a regular schedule)
E = Evaluated (assessment method other than fixed-station sampling)

4. GROUND WATER QUALITY

4.1 Ground Water Occurrence and Use

4.1.1. General Setting

Physiography (topography and climate) and geology (stratigraphy and structure) are the primary factors that control the distribution and quality of ground water resources in Montana. The general setting for the occurrence and distribution of water resources in Montana is described by the U.S. Geological Survey (USGS) in National Water Summaries (USGS, 1984 and 1985). A synopsis of information compiled by USGS is presented below.

Montana is included in three physiographic regions. The western and south-central portions of Montana lie in the Northern and Middle Rocky Mountains physiographic provinces. Eastern and north-central Montana are in the Great Plains physiographic province.

The Northern and Middle Rocky Mountain physiographic provinces are characterized by a series of mountain ranges separated by downfaulted intermontane valleys. As much as 16,000 feet of Cenozoic basin-fill sediments have accumulated in the deeper valleys. Annual precipitation ranges from about 8 inches in the drier valleys to over 120 inches in the high mountains.

Portions of Montana that lie in the Great Plains physiographic province are characterized by moderately dissected, rolling plains underlain by Cenozoic and Mesozoic sedimentary rocks. The plains are locally interrupted by small mountain ranges. Annual precipitation in the area ranges from 12 to 30 inches.

Generally the western mountain areas receive large amounts of precipitation that provides fresh water recharge to ground water systems. Unconsolidated sand and gravel aquifers situated in the valleys yield large volumes of good quality water. Much of the unconsolidated materials that fill the intermontane valleys are composed of relatively insoluble granitic rock material. When water flows over and through this material, minerals do not readily dissolve into the water.

Much less precipitation falls on the eastern plains and thus less fresh water is available to recharge water resources. Consolidated sedimentary aquifers in eastern Montana are more fine-grained than western alluvial aquifers and receive less recharge. Ground water movement is slower in the fine-grained aquifers, minerals contained in aquifer materials have a greater chance to dissolve into the water. Thus ground water in the eastern aquifers is poorer in quality and yields to wells are lower than the western alluvial aquifers. USGS (1985) estimates

that recharge to ground water from precipitation ranges from less than one inch in parts of the eastern plains to several inches in portions of the western mountains.

4.1.2 Ground Water Resources: Principal Aquifers

Ground water can be obtained from subsurface rock formations in Montana where the formations have sufficient permeability to transmit water and the formations are near the surface where they can be economically penetrated by wells. Formations that transmit usable quantities of water are termed aquifers. The distribution of aquifers and availability of ground water in Montana varies greatly across the state. The distribution of principal aquifer groups in Montana is shown on Figure 4-1.

Ground water in western and south-central Montana is stored in aquifers that consist of alluvial, glacial and basin-fill deposits of unconsolidated to semi-consolidated gravel, sand, silt and clay. Adequate water supplies for domestic and stock purposes can usually be obtained from depths of less than 200 feet. Yields are often sufficient to supply irrigation, public supply, or industrial uses. Ground water can also be obtained from consolidated bedrock formations located in mountainous terrains. The yield from wells constructed in mountain bedrock greatly depends upon the number of water-bearing fractures penetrated by the well bore.

In eastern and north-central Montana, ground water is available from alluvial and glacial deposits. Alluvial deposits are present along major river valleys. Alluvial aquifers yield water to private and public supply wells installed in the valleys along rivers. Pleistocene glacial debris, deposited by continental ice sheets, forms a veneer over much of north-central and northeastern Montana. Glacial aquifers hold adequate water supplies for stock and domestic needs. Ancient stream gravels buried by glacial drift are sometimes very productive, yielding sufficient water for irrigation.

Across the eastern two-thirds of Montana ground water is obtained from consolidated sedimentary formations. In areas where surface water resources are not readily available, buried sandstone, siltstone and limestone aquifers are tapped by wells to obtain water for public supplies, domestic and stock needs and limited irrigation or industrial purposes. Consolidated sedimentary aquifers in Montana, listed in order of increasing age, are as follows; Cenozoic Aquifer: Fort Union Formation, Mesozoic Aquifers: Fox Hills-Hell Creek, Judith River, Eagle and Kootenai Formations, and Paleozoic Aquifer: Madison Group.

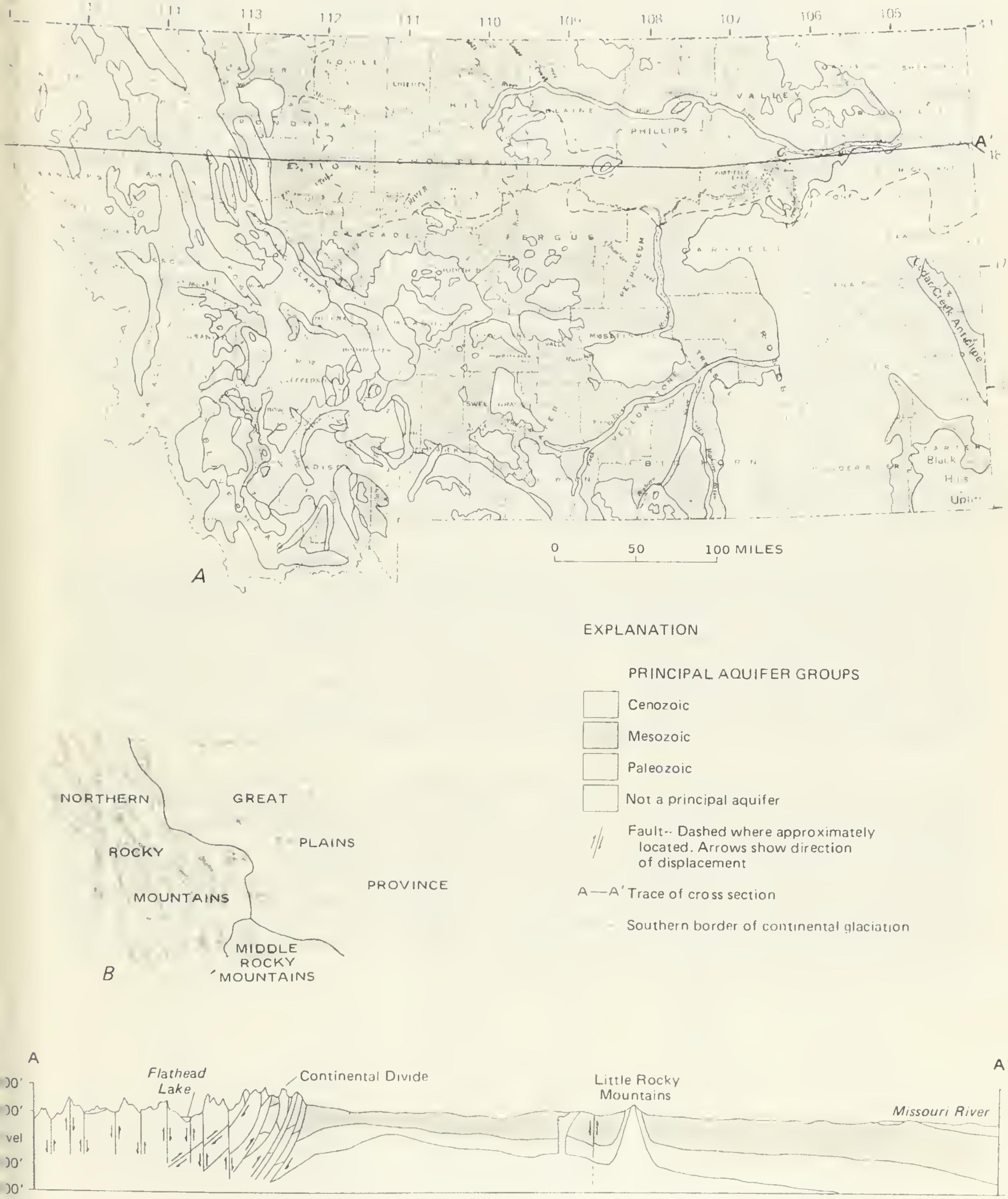

Figure 4-1. Principal aquifers in Montana. *A*, geographic distribution; *B*, physiographic diagram and divisions; *C*, generalized cross section (A-A'). (Source: U.S. Geological Survey. 1985. National Water Summary 1984. Water-Supply Paper 2275. 467 pp.)

Descriptions of the principal aquifers in Montana are presented in reports published by the Montana Water Resources Board, 1969, Montana Bureau of Mines and Geology, 1982 and U.S. Geological Survey, 1985. Information obtained from the above documents was compiled to generate a summary of the characteristics of the aquifers in Montana. Table 4-1 presents information on the name, description and thickness of the principal aquifers, characteristics of typical wells and data on location, use and total dissolved solids content of the ground water.

The Tertiary Fort Union Formation is a moderately consolidated sedimentary formation which is used as an aquifer in eastern Montana. The aquifer consists primarily of continental shale, siltstone, fine sandstone and coal. The Fort Union Formation has a known thickness of up to 2,200 feet and is exposed at the surface over vast areas of eastern and south-central Montana. Wells completed in the Fort Union Formation yield sufficient water for rural domestic and livestock needs.

Beneath the Fort Union Formation is a series of Cretaceous formations that consist mainly of alternating sandstone, shale, and siltstone layers. Sandstone units in this series transmit usable qualities of ground water.

The lower part of the Hell Creek Formation consists of sandstone interbedded with siltstone and shale. Where present, the underlying Fox Hills Sandstone is connected hydraulically to the Hell Creek. Together, these two units compose the Fox Hills-lower Hell Creek aquifer. This aquifer is used most extensively in Carter, Custer, Prairie, and Fallon Counties. Yields from the Hell Creek-lower Fox Hills generally are adequate for stock and rural domestic purposes and for public supply in some areas.

Below the Fox Hills Sandstone is a series of aquifers that consist mainly of thick sandstone layers separated by confining shale layers. The sandstone aquifers commonly yield adequate supplies for most stock and rural domestic needs and, in places, may yield adequate water for public supplies. Most of the wells are drilled near the outcrop areas of the aquifers or where a satisfactory shallower source of supply is not available. The water-bearing sandstones described below are presented according to age, beginning with the youngest.

Table 4-1. *Summary of the characteristics of principal aquifers in Montana and their use* (Modified after USGS 1985)

Aquifer Name and Description	Well Characteristics: Common Depth (ft.)	Well Characteristics: Common Yield (gal./min.)	Total Dissolved Solids Content of Ground Water	Principal Locations Where Used	Primary Uses
CENOZOIC AQUIFERS:					
Western alluvial and basin-fill deposits: Unconsolidated sand, gravel, silt and clay. Generally unconfined. 30 to 500+ ft. thick.	20 - 40	5 - 50 est.	Dissolved solids concentration generally less than 300 mg/L near Helena and Missoula. Water quality in other areas probably similar.	Western and Southcentral Montana valleys.	Public supply, domestic, stock, irrigation and industrial purposes.
Western glacial deposits: Unconsolidated sand, gravel, silt and clay. Unconfined to confined. 30 to 200 ft. thick.	50 - 300	5 - 50 est.	Dissolved solids concentration generally less than 200 mg/L in Northwestern Montana. Water quality in other areas probably similar.	Western and Southcentral Montana valleys.	Public supply, domestic and stock purposes; limited irrigation and industrial use.
Eastern alluvial deposits and terrace gravels: Unconsolidated sand, gravel, silt and clay. Generally unconfined. 30 to 200 ft. thick.	20 - 50	5 - 50 est.	Dissolved solids concentration generally less than 2,000 mg/L.	Central and Eastern Montana valleys.	" "
Eastern glacial deposits: Unconsolidated sand, gravel, silt and clay. Unconfined to confined. 10 to 100 ft. thick.	20 - 60	5 - 10	Dissolved solids concentration generally less than 2,200 mg/L.	Northcentral Montana.	" "
Fort Union Formation: Moderately consolidated and interbedded shale, siltstone, sandstone and coal. Unconfined to confined. Up to 2,200 ft. thick.	50 - 300	15 - 25	Dissolved solids concentration generally less than 1,800 mg/L.	Eastern and Southcentral Montana.	Domestic and stock purposes; limited public supply, irrigation and industrial.
MESOZOIC AQUIFERS:					
Hell Creek formation and Fox Hills Sandstone: Sandstone with some siltstone and shale. Confined except near outcrop areas. 500 to 1,200 ft. thick.	150 - 500	5 - 20	Dissolved solids concentration generally less than 1,200 mg/L. Includes Fox Hills - lower Hell Creek aquifer.	Carter, Custer, Fallon and Prairie Counties.	" "

Table 4-1. Continued.

Aquifer Name and Description	Well Characteristics Common Depth (ft.)	Common Yield (gal./min.)	Total Dissolved Solids Content of Ground Water	Principal Locations Where Used	Primary Uses
Judith River Formation: Sandstone with shale, siltstone, lignite and coal. Confined except near outcrop areas. 10 to 400 ft. thick.	200 - 600	5 - 15 est.	Dissolved solids concentration generally less than 2,300 mg/L in Central Montana. Water quality in other areas of Montana relatively unknown.	Phillips, Blaine, Hill and Valley Counties.	Domestic and stock purposes; limited public supply, irrigation and industrial.
Eagle Sandstone: Interbedded sandstone and shale. Confined except near outcrop areas. 250 ft. thick.	100 - 800	10 - 20 est.	Dissolved solids concentration generally less than 2,300 mg/L in Central Montana. Water quality in other areas of Montana relatively unknown.	Hill, Liberty, Chouteau, Glacier and Fergus Counties and along mountain flanks.	" "
Kootenai Formation: Sandstone, siltstone and shale. Confined except near outcrop areas. 400 to 500 ft. thick, basal sandstone 100 ft. thick.	100 - 900	10 - 30 est.	Dissolved solids concentration generally less than 500 mg/L near outcrop areas in Central Montana. Water quality in other areas of Montana relatively unknown.	Cascade, Judith Basin, Fergus and Petroleum Counties and along mountain flanks.	" "
PALEOZOIC AQUIFER:					
Madison Group: Limestone, dolomite, anhydrite and halite. Confined except near outcrop areas. 700 to 1,500 ft. thick.	500 - 3,000	- - - -	Dissolved solids concentration generally less than 5,000 mg/L but may exceed 300,000 mg/L in Northeastern Montana.	Not widely used except along mountain flanks.	Not widely used except for localized domestic and stock purposes.

The Judith River Formation is composed of sandstone, siltstone, shale, and lignite, and varies in thickness from a few feet to about 400 feet. The Judith River Formation is developed most extensively as a source of water in Phillips, Blaine, Hill, and Valley Counties. Beneath the Judith River Formation lies the Eagle Formation which is one of the more widely used aquifers in this group of water-bearing sandstone formations. The Eagle Formation consists of about 250 feet of sandstone, shaley sandstone, and a lower massive sandstone. Wells tap the Eagle Formation for water in Hill, Liberty, Chouteau, Glacier, and Fergus Counties.

The Kootenai Formation consists of 400 to 500 feet of red shale and brown to grey sandstone. The basal sandstone is about 100 feet thick and forms an excellent aquifer. Wells are drilled into the Kootenai Formation in Cascade, Judith Basin, Fergus, and Petroleum Counties near the flanks of mountain ranges.

The Mississippian Madison Group is the lowermost widespread aquifer in eastern and central Montana. It consists mainly of limestone and some dolomite and is 700 to 1,500 feet thick. Rocks of the Madison Group crop out mostly in mountain ranges but dip steeply away from the mountains and lie deeply buried in most of the eastern part if the state. The Madison Group has not been used extensively for water supplies because of the deep drilling that is required to reach the aquifer.

4.1.3 Ground Water Use

The United States Geological Survey (USGS) National Water Summary-1984 estimates that ground water, withdrawals constitute less than 2 percent of the total water withdrawals in Montana. However, about one-half of the states population is supplied with water for domestic purposes from ground water sources. The most recent comprehensive assessment of water use in Montana was conducted by the Montana Department of Natural Resources and Conservation (DNRC), Water Resources Division. A March 1986 report by the DNRC compiled data on Montana water use in 1980. The information was obtained from the National Water Use Data System which is a cooperative program between the USGS and the DNRC. A summary of ground water use information is presented in Table 4-2.

Table 4-2. Estimate of annual total water use and ground water use in Montana.

Use	Total Water Use (af)[a]	Ground Water Use (af)	Percent of Total
Irrigation	15,043,734	155,244	1
Municipal	157,128	61,156	39
Rural Domestic	16,307	15,913	98
Industrial	62,445	32,544	52
Livestock	27,505	8,791	32

[a] acre-feet

Water use information indicates rural domestic water users rely almost entirely on ground water as a source of potable water. More than half of the water for industrial purposes is obtained from ground water supplies. One third of municipal and livestock water demands are satisfied by ground water. The majority of water used in Montana goes to irrigation and only a minimum of that water is ground water.

4.2 Ground Water Protection

Montana has opted to administer many environmental control programs. For example, surface coal mining, hazardous waste, and solid waste, and pesticide control programs are operated by the state with federal support and oversight. Hard rock mining and milling activities obtain operating permits from the Montana Department of State Lands (DSL) which administers the Montana Metal Mine Reclamation Act.

Other large developments such as electrical transmission lines and coal-fired power plants are subject to requirements of a Major Facility Siting Act, which is administered by the Montana Department of Natural Resources and Conservation (DNRC). The DNRC Oil and Gas Conservation Division is currently developing regulations necessary to obtain authority from the United States Environmental Protection Agency (USEPA) to regulate Class II injection wells (wells used to dispose of produced waters or for enhanced recovery). Ground water protection is a primary consideration in all of these regulatory programs.

The Montana Board of Health on October 29, 1982, promulgated rules which are entitled the Montana Ground Water Pollution Control System (MGWPCS). The Department of Health and Environmental Sciences (DHES), Water Quality Bureau (WQB),

administers the MGWPCS with funds provided by the USEPA. A description of the MGWPCS is presented in Chapter 6, Section 3.

Potential sources of ground water pollution that are regulated by an industry-specific environmental control program must still satisfy the MGWPCS nondegradation policy and meet ground water quality standards. The WQB has agreements with several other state agencies to assist in the review of various permit applications and to insure that water quality concerns are thoroughly addressed. Pollution sources that are not permitted by other federally mandated or state permitting systems are required to obtain a MGWPCS permit.

Several staff members from different programs within the WQB are involved in ground water pollution control activities. Monitoring the field activities of the various staff members involved in ground water work was difficult until a field inspection tracking system was developed. The tracking system is utilized to generate and record inspection reports. Information entered into the tracking system includes site location and characterization data, as well as specifics on the type and number of compliance monitoring samples collected during the investigation.

Data from the tracking system can be retrieved at a later date and used as a management tool to determine how staff resources are expended or to evaluate a particular category of pollution sources. Table 4-3 summarizes information on the number of different types ground water related field investigations conducted during 1986 and 1987.

Table 4-3 indicates the majority of field investigations were conducted at petroleum storage tank leak sites. These data illustrate that releases of petroleum into ground water is a major problem in Montana. Inspections of DSL permitted sites ranked second in the number of ground water-related inspections conducted during the period. The DSL sites are usually large precious metals mining and milling sites which pose significant threats to water quality. Inspections of DSL sites are usually conducted with both WQB and DSL staff members present.

MGWPCS permits have been issued to 45 sites since the program began in late 1982. Most of the permits have been issued to small (less than five disturbed acres or 36,500 tons per year) precious metals extraction operations which are exempted from the DSL operating permit requirements. Small mining operations are required to conduct ground water monitoring near their cyanide heap pads and ponds or tailings disposal impoundments in accordance with a MGWPCS permit. Many of the MGWPCS sites operate sporadically and only 15 MGWPCS inspections occurred during 1986 and 1987.

Table 4-3. Summary of the different types of ground water-related field investigations conducted by the Water Quality Bureau staff during 1986 and 1987.

Inspection Type	Number of Inspections	Percent of Total
MGPCS Permitted Sites	28	15
DSL Permitted Sites	43	22
Petroleum Storage Tank Leaks	60	31
Spill Investigations	22	11
Citizen Complaint Investigations	22	11
Miscellaneous Sites	20	10
Total	195	100

The WQB has established a policy that all free petroleum products floating on the water table must be recovered at petroleum leak sites. Typical free product recover systems involve extraction of water and fuel from a recovery well or trench, separation and recovery of fuel at the surface and discharge of the separated water. The WQB requires MGWPCS permits at sites where systems are installed to recover spilled or leaked petroleum and the separated water is discharged to the subsurface on a long-term basis.

4.3 Ground Water Contamination Problems

Many different sources of ground water pollution are present in Montana. The severity of impacts on ground water posed by these sources depends upon the hydrogeologic setting, the type and volume of contaminants, existing or future beneficial uses of the ground water and the regulatory controls placed on the pollutant sources. Sources of ground water contamination are shown in Table 4-4. A list of the major substances that contaminate ground water in Montana is presented in Table 4-5.

Most large point sources of ground water are regulated in Montana by one or more federal, state, or local agencies to control and limit the release of pollutants. The following discussion describes some of Montana's ground water contamination problems.

Table 4-4. Sources of Ground Water Contamination in Montana.

SOURCE	RELATIVE PRIORITY OF MAJOR SOURCES
Septic Tanks	5
Municipal landfills	
On-site industrial landfills (excluding pits, lagoons, surface impoundments)	
Other Landfills	
Surface impoundments (excluding oil and gas brine pits)	
Oil and gas brine pits	
Underground storage tanks	1
Injection wells (incl. Class V)	
Abandoned hazardous waste sites	4
Regulated hazardous waste sites	
Land application/treatment	
Agricultural activities	6
Road salting	
Mineral Processing	3
Spills or Unanticipated Discharges	2

Table 4-5. Substances Contaminating Ground Water in Montana.

Organic chemicals:		Metals	X
Volatile	X		
Synthetic		Radioactive material	
Inorganic chemicals:		Pesticides	X
Nitrates	X		
Florides		Other agricultural chemicals	
Arsenic			
Brine/salinity		Petroleum products	X
Cyanide	X		
Other		Others (specify)	

X = Substances of major importance

4.3.1 Petroleum in Ground Water

Contamination of ground water by refined petroleum products has become one of the major pollution problems in Montana. Approximately 75 pollution incidents linked to contamination by petroleum are discovered by DHES each year. Most of the reports are related to leaking storage tank systems, including failed pumps or piping and fuel spilled during overfills. Tanker truck wrecks and pipeline leaks also contribute significantly to the problem.

The Montana Hazardous Waste Management Act has been amended to give DHES the authority to promulgate regulations to address underground fuel storage systems. However, corrective action requirements for fuel leaks have not yet been developed. The WQB has chosen to respond to petroleum leak reports under the MGWPCS until corrective action regulations are promulgated. Some of the sites with significant petroleum contamination problems are described below.

Burlington Northern Railroad Fueling Sites. The Burlington Northern Railroad (BNR) has agreed to investigate the extent of subsurface contamination caused by leaks and spills at locomotive fueling installations at 14 locations in Montana.

Preliminary investigations have been initiated at most of the sites. Recoverable amounts of fuel in the subsurface have been discovered at BNR sites in Helena, Livingston, Missoula, Laurel, Great Falls and Glendive. Nearly 100,000 gallons of diesel has been pumped from recovery trenches installed at the Helena BNR depot. Toxic constituents such as trichloroethene, chlorobenzene and 1,2 dichloroethene, were detected in ground water beneath the Livingston BNR site. These constituents are thought to emanate from the past improper disposal of shop wastes. Investigations at all of the BNR sites is ongoing.

Tracy's Chevron, Livingston. A release of an estimated 5,200 gallons of premium unleaded gasoline from a connecting pipe of an underground tank occurred during the summer of 1987 at Tracy's Chevron. The site is located in the central business district of Livingston and petroleum odors were first noticed in the basements of several downtown buildings. The quality of a public water supply well located less than 1,500 feet away is also threatened.

The responsible party was unable to implement investigative and corrective measures, therefore the USEPA Leaking Underground Storage Tank Trust Fund was tapped to finance remedial activities. Contractors, with oversight from the DHES Solid and Hazardous Waste Management Bureau, installed monitoring wells to track the spread of contaminated ground water and a soil venting system to mitigate fuel vapor problems.

4.3.2 Cyanide and Heavy Metals in Ground Water

The recent increase and stabilization of gold prices has made the recovery of precious metals from relatively low grade ores more viable. Numerous large and small precious metals extraction operations have been constructed in Montana during the last few years. Many of the operations utilize cyanide leach technology to remove gold from large volumes of ore. The escape of cyanide and heavy metals from heap leach pads and ponds and cyanide-bearing tailings disposal impoundments is a significant threat to ground water quality. Typical problems experienced at two of these sites are described in the following paragraphs.

Zortman Mining Inc., Zortman. Over 12 inches of above normal precipitation fell on leach pads at Zortman Mining's Zortman, Montana operation during 1986. The rainfall resulted in the accumulation of 28 million gallons of excess water that was contained behind valley-fill leach pad dams. Immense pressure created by the additional loading of the water threatened the integrity if the dams and catastrophic failure was thought to be imminent.

The excess precipitation mixed with the cyanide leach solution contained in the leach pads and the resulting mixture contained several hundred parts per million total cyanide. Remediation of the problem was effected by batch neutralization of the cyanide with chlorine treatment and land application of treated liquid on to forested lands. Surface and ground water monitoring below the land application area has detected only elevated level of chloride.

Golden Maple Mining Co., Giltedge. Heavy rainstorms caused cyanide leach solution containment ponds to overflow. Ground water downgradient of the site was contaminated with cyanide and heavy metals. Small springs which discharge from a bedrock limestone formation downslope from the site were also contaminated with low levels of cyanide. The springs are the source of potable water for a farm house and nearby livestock.

Corrective measures instituted by the site owner were unsuccessful. DHES filed suit and collected money from the owner's environmental liability insurance coverage. Funds were utilized to neutralize cyanide solutions retained in the leach pads, reclaim and re-vegetate the site surface, install ground water monitoring wells and conduct long-term monthly monitoring.

4.3.3 Pesticides in Ground Water

Widespread contamination of ground water by pesticides has not been detected in Montana. The Montana Department of Agriculture (MDA) has surveyed ground water quality for pesticides since 1984 at selected locations in Montana thought to

be susceptible to contamination. Study areas initially chosen were 1) seed potato production areas in Flathead and Lake Counties near Kalispell and Pablo, 2) alfalfa and hay fields along the Beaverhead River in Beaverhead and Madison Counties, and 3) irrigated spring wheat and barley area on the Greenfield Bench in Teton County near Fairfield. The survey was expanded in 1986 to include sugar beet growing areas near Billings in Yellowstone County and along the Clark's Fork of the Yellowstone River in Carbon County.

Field investigators selected sampling sites that were irrigated and had highly permeable soils, shallow water tables, and a history of pesticide use. Ground water samples were collected from over 65 wells. Samples were analyzed for groups of pesticides that are typically used on the particular crops grown in each area.

No pesticides were detected in ground water samples collected from the seed potato production areas in Flathead and Lake Counties or in the alfalfa and hay production areas in Beaverhead and Madison Counties. Low levels of 2,4-D, MCPA, dicamba and picloram were detected in the irrigated spring wheat and barley production area near Fairfield in Teton County, but the levels do not present an immediate health threat. Aldicarb residues were detected in ground water beneath the sugar beet growing area sampled in Carbon County, but were below the proposed Recommended Maximum Contaminant Level for Aldicarb in drinking water.

4.3.4 Regulated Waste Sites

The Montana Hazardous Waste Act (MHWA) and certain projects under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) are implemented by the DHES Solid and Hazardous Waste Bureau. The MHWA is Montana's counter-part to the federal Resource Conservation and Recovery Act (RCRA). Management of regulated wastes at active facilities is subject to MHWA requirements. CERCLA requirements apply to locations where regulated wastes are located at inactive or abandoned sites. The following is a status summary of MHWA and CERCLA sites in Montana where existing or potential ground water contamination problems occur.

4.3.4.1 MHWA Sites. Facilities that treat, store or dispose of hazardous wastes on-site in Montana have been operating under temporary or interim (Part A) permits since May 1980. These facilities are now in the process of applying for permanent (Part B) operating permits. Hazardous waste storage impoundments, waste piles, landfills and land treatment areas are required to implement stringent ground water monitoring programs as part of their Part B permits. The status of each MHWA facility in Montana is described below.

Burlington Northern Paradise Tie Treating Plant. Burlington Northern (BN) has submitted permit applications for the following activities:

1. Waste pile storage: BN currently stores approximately 18,000 cubic yards (cy) of creosote sludge and creosote-contaminated soils in a lined waste pile until treatment or final disposal. Ground water has been contaminated with polyaromatic hydrocarbons (PAHs) and is undergoing corrective action. DHES expects to issue a permit on November 7, 1988.
2. Land Treatment Unit: BNR has submitted a permit application for a 55-acre land farm to treat approximately 18,000 cy of creosote-contaminated soils stored at Paradise and approximately 18,000 cy of similar wastes expected to be generated as a result of a CERCLA cleanup at Somers, Montana. The Paradise storage area and proposed land farm overlie an unconfined alluvial aquifer hydraulically connected to the Clark Fork River.
3. Incineration Unit: BNR has also submitted a permit application of an incineration unit at the Paradise site.

Burlington Northern Somers Tie Treating Plant. In October, 1987 the MHWA surface impoundment at Somers was partially closed under a DHES approved plan requiring excavation of most of the contaminated soils (now stored at Paradise), a graded surface and an asphalt cap. The impoundment was capped in the spring of 1988. Low levels of PAHs have been detected in the ground water near the impoundment. Appropriate action is on hold pending development of a CERCLA superfund cleanup plan for the rest of the facility. The plan is currently under USEPA review.

CENEX Refinery - Laurel. CENEX has withdrawn a permit application for land treatment of petroleum refining wastes. Ground water wells downgradient from the active land farm show no contamination; however, analysis of soil core samples collected from below the treatment zone show indications of contamination. Cenex is in the process of completing a revised closure plan for DHES review.

EXXON and CONOCO - Land Treatment Facility - Billings. Each facility has submitted a permit application for land treatment of petroleum refining wastes. Ground water flow has been characterized and a DHES-approved monitoring network is in place. Both facilities have active land farms operating under RCRA interim status. DHES expects to issue operating permits for both facilities before November 8, 1988.

CONOCO - Billings Refinery. In July, 1987, the Conoco refinery underwent a RCRA Facility Assessment (RFA) by the USEPA used to evaluate the potential for releases of hazardous constituents

from solid waste management units. There is evidence of considerable amounts of oil leaking from storage tanks. Most of the oil is recovered by air interception trench. Negotiations are underway with a property owner downgradient from the Conoco tank farm to monitor the effectiveness of the interception system.

Montana Refining Company - Great Falls (MRC). Montana Refining Company has closed its land treatment unit under a DHES-approved plan that requires continued in-place treatment of hazardous waste followed by grading and revegetation. Montana Refining Company is currently undergoing a RFA facility assessment by the USEPA for releases of hazardous constituents throughout the facility.

Transbas Inc. - Billings. Surface impoundments used to store pesticide formulation wastes have been closed. As a condition for a post closure permit, Transbas has constructed a ground water biological treatment system designed to degrade a byproduct of 2,4-D to non-detectable levels. The treatment system has been installed and operating successfully since February 1988.

4.3.4.2 CERCLA Sites

Anaconda Smelter Site - Anaconda. Various levels of heavy metals have been detected near tailing impoundments and waste dumps on the smelter site. A Remedial Investigation and Feasibility Study (RI/FS) continues. Geochemical models are being developed to examine the fate of heavy metals emanating from the site and to examine the associated risks. Ground water is being studied on a regional basis and on the following operable units: Arbiter, Old Works, Smelter Hill, and Tailings areas. Geochemical studies have been conducted on the Tailings Operable Unit and preliminary ground water study has taken place on the Smelter Hill Operable Unit. The Old Works Engineering Evaluation/Cost Assessment will address how the Old Works affects Warm Springs Creek. The USEPA and DHES have conducted some preliminary surface hydrology at the Opportunity Tailings Ponds.

East Helena/ASARCO Site - East Helena. ASARCO, under oversight of the USEPA and DHES, completed a Phase II water resources investigation in December 1987. This investigation further delineated arsenic and sulfate contamination plumes in shallow ground water on and off the smelter plant site. Water samples from Prickly Pear Creek have shown minor increases in arsenic and some heavy metals downstream from the plant site. Methods to correct contamination will be examined in a draft feasibility study which is tentatively scheduled for completion in June 1989.

Libby Ground Water - Libby. Champion International, under the oversight of USEPA and DHES completed the final draft Remedial Investigation report in July 1987. Investigations revealed

significant contamination by creosote compounds and pentachlorophenol in the shallow and deep alluvial aquifers (up to 150 feet deep). Areas of ground water contamination have extended from the mill site to beneath the town of Libby. The draft feasibility study addressing corrective actions was completed in February 1987. Champion International is currently conducting a pilot-scale in-situ biodegradation study of the shallow aquifer using injected hydrogen peroxide.

Idaho Pole - Bozeman. Pentachlorophenol from wood treating operations has entered the ground and surface water in the vicinity of the Idaho Pole wood treating plant. The extent of the problem was studied by the company to comply with an DHES administrative order. Negotiations with the company on planning additional work on the remedial investigation and writing a feasibility study began during fiscal 1988.

Mouat Industries - Columbus. Hexavalent chromium is present in soils and ground water both on and off the site. This occurred due to improper handling of chromium ore processing wastes. As soon as funds are available through CERCLA RI/FS will begin.

Burlington Northern Railroad Somers Tie Treating Plant - Somers. Wood-treating wastes have seeped into the ground water and have also entered Flathead Lake via a drainage ditch. To prevent the release of further contaminants into the lake contaminated materials have been excavated from an old pond and a dike was constructed along the lakeshore. The USEPA and DHES are currently reviewing the RI/FS put together by Burlington Northern Railroad.

Montana Pole - Butte. Pentachlorophenol and petroleum from wood treating and preservation operations have contaminated ground water and entered Silver Bow Creek. The DHES ordered Montana Pole and Treating to take corrective action in May 1984, and the USEPA started removal actions at the site in July 1985. A ground water pump-back system has been installed to prevent contaminated ground water from reaching Silver Bow Creek. Recovered liquid is pumped through an oil separator with the pentachlorophenol and petroleum mixture collected in tanks and stored on-site and the water fraction reinjected upgradient into the alluvial aquifer. Additional investigation work (RI/FS) began in mid-1988 and corrective actions will be evaluated to clean up the remaining contamination.

Milltown Reservoir - Bonner/Milltown. Sediments at the Milltown Dam are rich in heavy metals carried downstream from years of mining and smelting activities in the Butte and Anaconda area. Arsenic in the sediments leached into the domestic wells of a majority of the Milltown residents, so DHES installed a municipal water supply, free of arsenic. A consulting firm has been chosen to conduct additional RI/FS work.

Silver Bow Creek - Butte to Milltown. Phase I RI/FS has been completed for several operable units and Phase II has begun. The current emphasis is on the Warm Springs Ponds system and the Streambank Tailings and Revegetation Study (STARS). The purpose of the Warm Springs Ponds Studies is to determine the viability of the pond system which was originally designed by Anaconda Minerals Company to settle out heavy metals in Silver Bow Creek. The purpose of STARS is to develop and test innovative remedial measures which will modify the streambank tailings adequately so they can be revegetated. This should reduce the availability of heavy metals to Silver Bow Creek.

In the Butte Addition portion of the site, studies are ongoing to assess the rise of water in mine shafts and in the Berkeley Pit. The rising water is the result of Anaconda Company's discontinuation of pumping of ground water from mine shafts under Butte and Walkerville. Investigations reveal that the rising ground water contains high levels of heavy metals.

4.3.4.3 Preliminary Assessment/Site Investigation (PA/SI)

Additional investigations have been funded by CERCLA to examine other location in Montana that may justify ranking on the National Priorities List of CERCLA sites. PA/SI work has been conducted at numerous sites where contamination of soils, surface or ground water is suspected. PA includes review of existing and historical information pertaining to a site, evaluation of the site's physical characteristics and an examination of potential impacts to the surrounding population and environment. If the PA suggests potential threats exist, an SI is conducted. Sampling of waste materials, soil and surface water is included in the SI. Monitoring wells are often installed at sites where existing wells do not provide adequate ground water samples.

4.3.4.4 Emergency Removal Actions

Montana Pole - Butte. The USEPA conducted emergency removal action on contaminated soils and ground water at the Montana Pole treating plant starting in 1985. During 1988, emergency removal will continue only at an operation and maintenance level with the site moving into the RI/FS stage.

Walkerville Removal Action - Butte Addition of Silver Bow Creek Site. In 1987, the USEPA's emergency response team began to assess the need for a removal action in the Walkerville area adjacent to Butte. High levels of heavy metals, especially arsenic, in residential areas necessitated an emergency removal of contaminated soils.

4.4 Ground Water Research

4.4.1 Introduction

Ground water research in Montana is conducted by a variety of agencies. Ground water investigations conducted by WQB are generally directed toward documentation of water quality violations. The principal ground water research agencies in the state are the Montana Bureau of Mines and Geology (MBMG) and the United States Geological Survey (USGS).

Water Quality Bureau ground water grant funds have recently been used to contract for specific studies in areas where possible ground water quality violations need additional study. Also, WQB has occasionally assisted local governments in their own investigations of ground water problems. Occasionally, when a ground water quality problem is discovered, the city or county staff collects samples from the problem area and the WQB pays for the necessary analytical services. A brief description of some of the major ground water research activities in Montana is presented below.

4.4.2 United States Geological Survey

Statewide monitoring. This monitoring involves the collection of ground water quality samples at about 90 sites in eastern Montana on a 4-year rotational basis (20 samples per year). Data are used to support various studies of regional ground water quality.

Clark Fork River Alluvium. This study examines the hydrology and water quality of shallow alluvial aquifers along the Clark Fork River from Warm Springs to Milltown.

Hanging Woman Creek. The ground water hydrology and water quality of coal, sandstone and alluvial aquifers in the Hanging Woman Creek basin of southeastern Montana are being investigated to evaluate the potential effects of coal mining on Hanging Woman Creek and associated alluvial aquifers.

4.4.3 Montana Bureau of Mines and Geology

Glacial Aquifer Study. Glaciofluvial and buried preglacial aquifers in the Havre and Harlem quadrangles are being identified.

Coal Lands Monitoring. The coal lands hydrologic monitoring study utilizes more than 200 observation wells in and near coal mines in southeastern Montana.

Ground Water Information Center. The Bureau of Mines provides ongoing maintenance and operation of a ground water information center library, basic data interpretation and field services.

4.4.4 Water Quality Bureau Funded Studies

Evergreen Septic Study. Monitoring of unsaturated and saturated zones to evaluate impacts of drainfield septic wastes on the Evergreen shallow aquifer.

Missoula Valley Aquifer DRASTIC Study. Missoula City-County Health Department is conducting a standardized evaluation of ground water pollution potential using hydrogeologic settings.

Goss-Shilling Subdivision. Richland County Health Department staff is collecting ground water samples from domestic wells and monitoring wells to evaluate extremely high nitrate concentrations in ground water.

5. WETLANDS

Wetlands are areas saturated by surface or ground water that support vegetation adapted for life in wet soils. They include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats and natural ponds.

Montana wetlands are important resources. They provide habitat for wildlife--particularly nesting, rearing and resting sites for migratory waterfowl. Wetlands produce food for animals in both the wetland and adjacent terrestrial communities. They control floods by retaining water during periods of high runoff, then releasing it gradually. Many ground water aquifers are fed by wetland recharge. Wetlands also serve as nutrient traps, chemical sinks, erosion barriers and sedimentation basins, thereby improving water quality.

Relatively little information is available regarding water quality in Montana wetlands. Elevated concentrations of salts, selenium and other trace elements, and pesticides from agricultural and irrigation practices are the principal water quality concerns in Montana wetlands.

In September 1985, Montanans became concerned about contamination of wetlands from naturally occurring selenium and other toxic elements. These concerns first surfaced when articles published by the Sacramento Bee newspaper (and later reprinted in state newspapers) reported findings of selenium in water, sediment, algae and plant material at 23 sites in nine western states. Many of the sites were in or near U.S. Bureau of Reclamation irrigation projects and national wildlife refuges. The Montana sites included Benton Lake National Wildlife Refuge, Lake Bowdoin National Wildlife Refuge, the Fairfield Bench Irrigation Project, Freezeout Lake and the Huntley Irrigation Project (Figure 5-1).

In response to the findings published in the Sacramento Bee, the U.S. Department of Interior (DOI) proposed studies to evaluate the extent of contamination by selenium and other toxic constituents at Fairfield Bench. Preliminary information showed little reason for concern at the Huntley Irrigation Project.

In the summer of 1986 the DOI conducted field sampling and analysis of water, sediment and plant and animal tissue for a variety of toxic constituents at Bowdoin National Wildlife Refuge (called Milk River Irrigation Drainage Reconnaissance Study) and at Freezeout Lake-Priest Butte Lakes Game Management Area, Fairfield Bench Irrigation Project and Benton Lake National Wildlife Refuge (called Sun River Irrigation Drainage Reconnaissance Study). Final report for the Milk River and Sun River studies were published by DOI in December 1987. Results have demonstrated contamination of water, bottom sediment, and

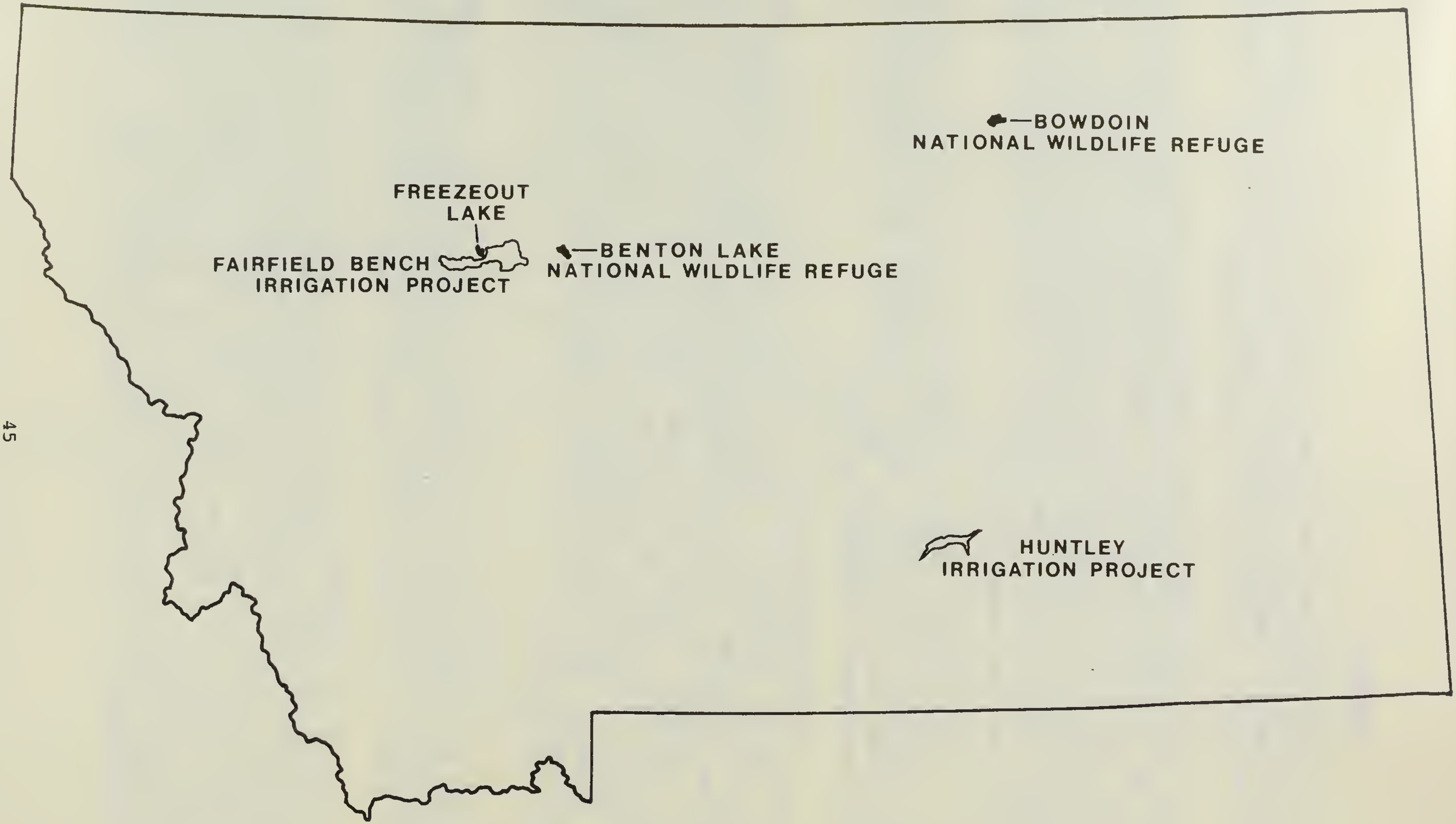

Figure 5-1. Sites in Montana investigated for selenium contamination by the <u>Sacramento</u> <u>Bee</u> and the U.S. Department of Interior.

biological tissues at Freezeout Lake and Benton Lake. Elevated levels of some toxic constituents have been found to be associated with saline seeps. (See also section 3.4.1.)

The DOI studies provide important information, but the actual loss of destruction of wetlands continues to be the main concern.

The U.S. Fish and Wildlife Service (USFWS) is conducting a nationwide inventory of wetlands. It will expand a partial survey done in the 1950's. The earlier survey was confined to the 15 northern Montana or "Hi-line" counties and a portion of Lake County.

The earlier study estimated Montana had 187,400 acres of wetlands, or approximately two-tenths of one percent of the state's area. The latest National Wetlands Inventory is expected to provide greater detail and a more accurate assessment of the quantity of wetlands in Montana. Maps will be prepared to show the location of wetlands. The inventory will identify each area according to the USFWS classification system.

Two 1:100,000 scale maps are available now: Ekalaka SW and Hardin SE. In mid-1988 five more maps will be available: Wolf Point NE and SE, Glasgow NW and SW, and Havre NE. And in late 1989, eight additional wetland inventory maps will be available: Cutbank NW and SW, Choteau NW and SW, Kalispell NE and SE, and Wallace NE and SE. By the end of 1989 approximately 17 percent of Montana will have wetland inventory maps available.

Without more information from the wetlands inventory it is difficult to assess the status of Montana's wetlands; however, it is certain they are being lost to development. The actual rate and significance of the losses cannot be measured until the inventory is completed.

State and federal agencies will continue to work together to protect Montana wetlands. A two-day Montana wetlands workshop was held in June 1986. This workshop raised the level of awareness of Montana's federal and state workers regarding the values of wetlands and the need for wetland protection. Proceedings from this workshop have been published and are available through Montana State University.

Government programs that affect wetlands include:

Bureau of Land Management	Grazing and land exchange
Forest Service	Logging, grazing and road building
Department of Highways	Road construction and

Federal Highway Administrations	maintenance
Department of State Lands	Logging, grazing and mining
Bureau of Reclamation Department of Natural Resources and Conservation	Water resource development
Conservation Districts Extension Service Agricultural Stabilization and Conservation Service Soil Conservation Service	Agricultural activities and agricultural program implementation
U.S. Fish and Wildlife Service	Wetland refuge management
Department of Fish, Wildlife and Parks	Waterfowl habitat protection

Executive Order 11990 ("Protection of Wetlands") requires all federal agencies to minimize the loss, destruction and degradation of wetlands. In addition, the U.S. Fish and Wildlife Coordination Act requires all federal agencies to consult with USFWS and the DFWP whenever federal activities are proposed that impact fish and wildlife resources, including wetland habitat.

The U.S. Army Corps of Engineers administers the Dredge and Fill Permit Program in Montana under Section 404 of the U.S. Clean Water Act. This program regulates the proposed destruction and filling of wetland areas.

The Environmental Protection Agency established the environmental criteria [404(b)(1) Guidelines] by which dredge and fill permits are evaluated. EPA also has enforcement authority where unauthorized discharges to wetlands occur, and has increased its emphasis upon utilization of this enforcement authority.

The USFWS comments to the Corps of Engineers on 404 permit notices. They also manage several wetland wildlife refuges (Medicine Lake, Lake Bowdoin, Benton Lake, Lee Metcalf, and Ninepipe National Wildlife Refuges). The USFWS also administers a wetland acquisition program whereby important and threatened wetlands can be obtained through perpetual easement or direct purchase. More than 22,000 acres had been acquired through this program in 22 Montana counties through February 1982. In 1984 and 1985, 1,962 wetland acres were acquired by purchase and 227 acres by easement. In 1986 and 1987, 1,416 acres were acquired by purchase. In addition, 1,673 acres were

purchased for addition to the Red Rock National Wildlife Refuge and 3,279 acres were purchased for the new Halfbreed National Wildlife Refuge.

The Montana Department of Health and Environmental Sciences (MDHES), Water Quality Bureau, reviews 404 permit notices for compliance with state water quality standards and, if appropriate, provides Section 401 certification to assure that permitted discharges will not violate water quality standards.

The Montana Water Quality Act and associated water quality protection programs and rules do not principally address or focus upon wetland protection. The Act and these programs apply to "state waters". State waters means any body of water, irrigation system, or drainage system, either surface or underground [MCA 75-5-103 (9)]. It is the policy of the MDHES that all wetlands are alone, or by virtue of hydraulic connection to other state waters, considered "state waters" in Montana. Wetlands, therefore enjoy the same protections provided to all other state waters in Montana under the Montana Water Quality Act. Principal among these protections is that pollution of state waters is prohibited (MCA 75-5-605). The Water Quality Act (MCA 75-5-605) also prohibits placement of wastes in a location where they are likely to cause pollution of state waters. The general prohibition against pollution of state waters and the MDHES policy to consider wetlands to be state waters (by virtue of their hydraulic connection to other state waters) provides broad regulatory protection against pollution of wetlands.

The ASCS of the U.S. Department of Agriculture (USDA) administers the Water Bank Program whereby private landowners enter into 10-year agreements not to destroy selected wetlands in return for annual payments. There are 124 active agreements covering a total of 18,746 acres of which 3,205 acres are wetlands and 15,541 acres are adjacent to wetlands. The total annual payment on these agreements is $301,985. Water Bank agreements are offered in Daniels, Flathead, Glacier, Lake, Pondera, Roosevelt, Sheridan and Teton counties.

The 1985 Farm Bill includes a wetland conservation provision that eliminates USDA agricultural program subsidies to persons converting wetlands to agricultural production. This is frequently referred to as the "swampbuster" provision. Crops which do not require annual tilling, such as alfalfa, are not covered by this provision.

Recent revisions to the USDA Conservation Reserve Program have allowed payments to farmers for taking strips of land adjacent to perennial streams and wetlands out of production.

The Bureau of Land Management (BLM), U.S. Department of Interior, manages more than eight million acres of land in Montana. The BLM estimates that its land contains approximately 33,000 acres of marshes, wet meadows and seeps, 143,000 acres of riparian areas and 15,600 acres of lakes and ponds. The BLM has filed for water rights on more than 4,300 pothole areas under their jurisdiction in northeastern Montana.

The DFWP administers 45 wildlife management areas. Nineteen of these areas contain wetlands. The DFWP also has been assisting the USFWS with National Wetlands Inventory, particularly with verification and analysis of wetlands identified in aerial photos. The DFWP also has been working with the Montana Department of Highways to assist with identification and mitigation of wetland impacts from highway construction.

Finally, the Montana Natural Streambed and Land Preservation Act requires private parties to obtain permits from local conservation districts for stream construction activities. Similarly, the Montana Stream Protection Act requires agencies of state and local government to obtain permits from the DFWP. Neither of these state programs, however, extends regulatory protection to wetland areas such as marshes, bogs, potholes and ponds. The focus for wetland protection under Montana state government is unclear. Efforts are being made, however, to improve interagency coordination and clarify roles and responsibilities.

6. WATER POLLUTION CONTROL PROGRAMS

This chapter describes the water pollution control programs of the Department of Health and Environmental Sciences (DHES). Brief reports are given on status, accomplishments, problems and objectives of each program. The DHES is not alone in these efforts; there are similar programs at all levels of government to accomplish many of the same water quality goals. But the DHES is the primary agency responsible for administering and enforcing state and federal water pollution control and water supply laws.

6.1 Point Source Control Programs

6.1.1 Construction Grants Program

The 1987 Amendments to the Clean Water Act prescribe the method by which the Construction Grants Program is to be eliminated. While the grants program is being phased out, a new revolving loan program using state and federal funds will be intiated. Appropriations for grants will be received until 1990 with appropriations in 89 and 90 to be half the normal amount received. The remaining half will be provided to the states to capitalize the revolving loan program. Federal funds will be provided until 1994 to continue the loan program after which loan payments and proper management will make the program self-sufficient.

The Construction Grants Program continues to be a major factor in addressing Montana's wastewater treatment needs. A number of towns subject to EPA's National Municipal Policy (NMP) are being financed with grant assistance with compliance expected before the July 1, 1988 deadline (see Table 6-1). Interest in new facilities planning projects funded with advance of allowance grants showed a marked increase in 1987. This planning work, along with ongoing design/construction projects, indicate that demand for the federal grant assistance will continue until the funds are exhausted.

Construction of four wastewater treatment facilities to reduce phosphorus loads to Flathead Lake began in 1987. The Bigfork project is complete and currently removing phosphorus to acceptable levels. Construction is underway in Columbia Falls, Whitefish, and Lakeside with completion expected in the summer of 1988. Planning projects in Somers and Big Arm will begin in 1988 to evaluate the impacts of these unsewered communities on the lake.

A new inspection program was initiated in 1987 to enable a comprehensive evaluation of grant-funded wastewater treatment facilities and their ability to meet effluent standards. The inspection process considers the operation of

the treatment plant, the role and attitudes of the administrators, and the physical limitations of the facilities. The goal of the program is to identify performance limiting factors and work towards compliance maintenance by eliminating the major limiting factors. Local cooperation in meeting the program goals has been excellent.

Table 6-1. NMP Projects funded by construction grants

Big Fork	Bearcreek	Browning
Chester	Chinook	Columbia Falls
Deer Lodge	Dillon	Ekalaka
Ennis	Fromberg	Hamilton
Harlem	Havre	Joliet
Laurel	Lewiston	Libby
Rocker	Sunburst	Whitefish
Wolf Point		

6.1.2 Pretreatment Program

The goal of the National Pretreatment Program is to protect municipal wastewater treatment plants and the environment from the adverse impact of hazardous or toxic wastes that are discharged into sewage systems. Although approximately 25 states have developed authorities and regulations to operate pretreatment programs as part of their point source discharge permitting program, the State of Montana does not yet have such authority. Therefore, the Montana EPA Office in Helena has the lead role in working with municipalities and industries throughout the state to minimize adverse impacts from non-domestic waste discharges to sewer systems.

The four main problems that can be prevented through implementation of a local pretreatment program are:

1. Interference with municipal treatment plant operations;
2. Pass-through of pollutants into receiving streams;
3. Municipal sludge contamination; and
4. Exposure of workers to chemical hazards.

Limitation of pollutants into sewage systems is addressed through prohibited discharge standards, categorical pretreatment standards and local limits. Prohibited discharge standards apply to all industrial and commercial users, and prohibit discharge of flammable, explosive, corrosive or other interfering substances. Categorical pretreatment standards apply to industrial and commercial discharges in 25 specific industrial categories determined to be the most significant sources of toxic pollutants. Each city may also establish and enforce local

limits necessary to provide the degree of protection needed for its particular situation.

The cities of Billings, Bozeman, Butte, Helena, Great Falls and Missoula have all developed EPA-approved local pretreatment programs to regulate industrial users of their systems. Each of these communities has conducted industrial inventories and established legal authorities to identify and control potentially harmful discharges. Assistance is provided as needed by EPA and the DHES to other smaller communities in Montana that may be impacted by industrial waste discharges.

6.1.3 Permits Program

The Permits Program administers: 1) the Montana Pollutant Discharge Elimination System (MPDES), 2) the Montana Surface Water Quality Standards (MSWQS) and 3) the Montana Groundwater Pollution Control System (MGWPCS).

Under MPDES, all point-source waste discharges to surface waters must be permitted by the DHES. Each permit contains limitations and conditions which ensure that state water quality standards and the state's policy of nondegradation will not be violated by the discharge. The DHES has 180 days to process an application, which includes public participation and a hearing, if requested. The DHES requires and reviews self-monitoring by permittees, conducts laboratory quality assurance inspections, field inspections and monitoring and takes enforcement actions to bring dischargers into compliance with permit conditions. Permits are reevaluated and renewed on a regular basis, not to exceed five years. All information on permits is supplied to the EPA.

Under MSWQS, complaints of water pollution are investigated and resolved; plans for short-term instream construction are reviewed and modified to reduce the effects on water quality, and plans for leach pads, tailings ponds and ponds used in the processing of ore are reviewed to ensure that toxic chemicals will not escape and degrade water quality. MSWQS are also used as a basis for MPDES permit conditions.

The Permits Program promulgated general discharge permit regulations through the Board of Health in June 1982. Since then, MPDES general permits have been issued for small suction dredges, facultative sewage lagoons, feedlots, fish farms and construction dewatering operations. These permits enable applicants in the listed category to be assigned the appropriate general permit for operation. This has saved processing and administrative time. In 1986 and 1987, 60 and 62 authorizations were issued, respectively, under the various general permits. In 1987, both the construction dewatering and suction dredge general permits were renewed.

The DHES Permits Section administers about 310 individual MPDES permits. Around 225 more authorizations are administered under the 5 general MPDES permits. In 1986-1987, 12 major municipal and 6 major industrial permits were issued or modified, along with 23 minor municipal and 72 minor industrial permits. In 1988-1989, 22 major municipal and 14 major industrial permits will need to be issued (Table 6-2). Probably more than 100 minor permits will be issued as well. Other activities include corresponding with permittees, reviewing approximately 1500 self-monitoring reports a year, following-up on violations, compliance monitoring and quality assurance work with laboratories and inspecting facilities. Also the DHES is updating the MPDES regulations and the MPDES delegation agreement.

Starting in 1988, the DHES will be placing additional requirements in major MPDES permits for biomonitoring and sludge monitoring. This is designed to assess the problems and control the discharge of toxic pollutants. If toxic pollutant problems are discovered in discharges through the bioassay screenings or sludge monitoring, the DHES and discharger will work together to accomplish appropriate resolution of the problem.

Tracking of MPDES permittee self-monitoring and compliance formerly was done manually from reports sent in by the permittees. Beginning in 1987, the staff has been using the EPA Permit Compliance System (PCS) database and a computer system as an aid in handling the large amount of data generated by the many MPDES permittees. The computer system will allow easier access to permit information and enable staff to use data in various report formats. Compliance schedules, facility data, enforcement records, compliance sampling and inspection data and self-monitoring data will be stored and retrieved.

Special attention has been given to permittees in the Flathead Lake drainage due to eutrophication problems and the 1984 DHES phosphorus strategy. Phosphorus limits have been imposed on all permits, and compliance schedules have been required of those facilities which cannot presently meet the 1.0 mg/l limit on total phosphorus.

Additionally, the DHES is taking a close look at the Clark Fork River due to public concern over maintaining water quality. One outcome could be nutrient limitations being placed on permittees in the basin to protect against nuisance algae growth in the river and in Lake Pend Oreille, Idaho. Further nutrient studies are underway and must be completed before final decisions can be made.

The National Policy for Wastewater Treatment Facilities calls for all municipal wastewater treatment facilities to meet national secondary treatment standards by July 1, 1988. All municipalities needing upgrading have been required to have firm compliance schedules since October 1, 1985.

Table 6-2. Major permits to be issued, 1988-1989.

Major Industrial	Major Municipal
MDU - Sidney	Lewistown
MPC - Corrette	Hardin
Anaconda Minerals - Great Falls	Dillon
Montana Resources - Butte	Conrad
Flying J	Whitefish
Montana Gold & Sapphires	Baker
Champion - Libby	Butte
Conoco, Inc.	Billings
Exxon Co. USA	Bozeman
Farmers Union Central Exchange	Havre
Montana Refining Co.	Kalispell
Montana Rail Link - Livingston	Missoula
Champion - Bonner	Great Falls
Western Energy	Deer Lodge
	Glendive
	Miles City
	Cut Bank
	Glagow
	Polson
	Hamilton
	Wolf Point

6.1.4 Enforcement Program

Enforcement pursuant to the Montana Water Quality Act (WQA) is taken to accomplish several general goals. These goals include:

1. To eliminate or abate pollution of state water;
2. To encourage corrective actions necessary to prevent the recurrence of a water pollution situation;
3. To modify a situation which has the potential to cause pollution of state waters;
4. To assess and collect civil penalties;
5. To recover DHES enforcement costs.

A variety of enforcement options are provided in the act for accomplishing these goals, and for any given situation a determination is made based on the options.

Tables 6-3 and 6-4 summarize enforcement actions taken during calendar years 1986 and 1987 under the Montana WQA, the Montana Safe Drinking Water Act (SDWA), and the Montana Sanitation in Subdivisions ACT (SSA). Formal enforcement actions initiated in 1986 and 1987 under the WQA and SDWA are listed in Tables 6-5 through 6-8.

During 1986 and 1987 three unique enforcement actions were taken against owners of public water supplies under the Montana Safe Drinking Water Act. All three were follow-up actions against defendants who had failed to comply with previous court orders issued on the Department's behalf.

In the fall of 1986, the Department initiated a successful court action against the owner/operator of public water supply systems serving two trailer courts who was failing to consistently monitor for bacteriological quality, and whose few samples were contaminated. The Court granted a Department Motion for Contempt and levied a $500 fine, it also granted a Department Motion to require the Defendant to pay the costs of a court appointed Administrator ($2000) who would comply with Safe Drinking Water Act requirements for one year. And finally, the Court required the Defendant to pay the Department $350 in enforcement costs. This action was listed in the 1986 summary.

In another case during this time frame, the Department requested the county attorney's assistance in filing successful criminal charges against the operator/owner of a public water supply. The Defendant was found guilty, paid a fine, and was ordered to comply with the requirements of the Safe Drinking Water Act. This action is not included in the preceeding summaries because it was initiated by the local county attorney.

Table 6-3. Calendar year 1986 summary of enforcement activities.

120	Citizen Complaints investigated by the Helena Office (no data available for Billings Office)
14	Violation Report Forms transferred to Legal Unit requesting Formal Enforcement Action (11 WQA, 2 SDWA, 1 SSA)
2	Administrative Enforcement Orders were issued (1-WQA, 1-SSA)
5	Civil Complaints were filed in District Courts (4-WQA, 1-SDWA)
$17,000.00	in Civil Penalties were collected (6 cases) under the Water Quality Act
$ 4,700.10	in Agency enforcement costs were collected ($4,420.10 WQA (6 cases), $350.00 SDWA (1 case)
$24,000.00	in Civil penalties were assessed, but suspended by court order pending performance (2 cases)

Table 6-4. Calendar year 1987 summary of enforcement activities.

127	Citizen complaints investigated - Helena Office (no data for Billings office)
17	Violation Report Forms transferred to legal Unit requesting Formal Enforcement Action (10 WQA, 5 SDWA, 2 SSA)
1	Administrative Enforcement Order was issued (WQA)
17	Civil Complaints were filed in District Courts (10 WQA, 6 SDWA, 1 SSA)
$28,750.00	in Civil Penalties were collected (5 cases WQA, 1 case SSA)
$ 4,184.32	Agency Enforcement Costs were collected (5 WQA cases)
$ 3,050.00	Civil Penalties were Assessed, but suspended by court order pending performance (1 WQA case, 1 SSA case)

Table 6-5. Formal Enforcement Actions Initiated During 1986 Pursuant to the Montana Water Quality Act

NAME	DATE	TYPE BUSINESS	VIOLATION	CHARACTER OF POLLUTANT	TYPE OF ACTION
Falcon/GRS/Berg NR Helena, MT	06-25-86	Cyanide Leach	U.A.D. - P.W.	Cyanide Process Waters	Civil Comp.[1]
City of Missoula	05-21-86	Municipality	E.L.V. - P.V.	Domestic Sewage	Civil Comp.*
Cont. Pipe Line Co. McDonald Pass, MT	07-24-86	Buried Pipe Line Co.	C.P. - U.A.D. P.W.	Unleaded Gasoline	Civil Comp.[1]
Helena Sand & Gravel Helena, MT	08-06-86	Construction Company	C.P. - E.L.V P.V.	Suspended Solids	Civil Comp.*

1 = Pending resolution
* = Settled
A.O = Any formal administrative order taken to achieve compliance
Civil Comp = Any formal action initiated through petition of the District Court
C.P. = Causing pollution
E.L.V. = Effluent limitation violation
P.V. = Permit violation
P.W. = Placing wastes
U.A.D. = Unauthorized discharge

Table 6-6. Formal Enforcement Actions Initiated During 1986 Pursuant to the Montana Safe Drinking Water Act

NAME	DATE	TYPE BUSINESS	VIOLATION	TYPE - ACTION
Thiel Trailer Cts Marcel Theil Havre, MT	10-27-86	P.W.S. Trailer Courts	F.T.M. Mcl. V.	Civil Complaint * Application for Contempt * 1 Appoint. of Admin.

1 = Pending resolution
* = Settled
A.O = Any formal administrative order taken to achieve compliance
Civil Comp = Any formal action initiated through petition of the District Court
F.T.M. = Failure to monitor
Mcl. V. = Maximum contaminant level violation
N.C.O. = No certified operator
P.& S.V. = Plans and specifications violation
P.W.S. = Public water supply
T.S.S.V. = Ten States Standards violation

Table 6-7. Formal Enforcement Actions Initiated during 1987 pursuant to the Montana Water Quality Act

NAME	DATE	TYPE BUSINESS	VIOLATION	CHARACTER OF POLLUTANT	TYPE OF ACTION
BNRR Columbus, MT	01-14-87	Construction Repair Railroad Company	C.P. - P.W.	Suspended Solids Sediment	Civil Comp.*
Western Sugar Co. Billings, MT	04-02-87	Sugar Beet Processing	E.L.V. - P.V.	BOD	Civil Comp.*
Denimil Resources Pony, MT	05-07-87	Ore Processing	E.L.V. - P.V.	pH	Civil Comp.[1]
George Cook/Valley Ditch Manhattan, MT	06-30-87	Irrigation Co.- Agri.	C.P. - P.W.	Suspended Solids Sediment	Civil Comp.[1]
ASARCO, Inc Troy, MT	06-30-87	Ore Mining & Processing	C.P. - P.W.	Sediment Metals	A.O.[1]
Maronick Construction Helena, MT	10-29-87	Construction Company	U.A.D. - C.P.	Suspended Solids Sediment	Civil Comp.*
City of Helena, MT	09-14-87	Municipality	U.A.D. - C.P.	Chlorine	Civil Comp.[1]
BNRR Livingston, MT	10-22-87	Railroad Company	C.P. - P.W.	Misc. Solvents Fuels	Civil Comp.[1]
Biggs Logging Somers, MT	10-26-87	Logging Company	C.P. - P.W.	Suspended Solids Sediment	Civil Comp.*
Pelican Truck Stop Laurel, MT	11-06-87	R.V. Park - Bar	C.P. - P.W.	Domestic Sewage	Civil Comp.[1]

1 = Pending resolution
* = Settled
A.O = Any formal administrative order taken to achieve compliance
Civil Comp = Any formal action initiated through petition of the District Court
C.P. = Causing pollution
E.L.V. = Effluent limitation violation
P.V. = Permit violation
P.W. = placing wastes
U.A.D. = Unauthorized discharge

Table 6-8. Formal Enforcement Actions Initiated During 1987 Persuant to Montana Safe Drinking Water Act

NAME	DATE	TYPE BUSINESS	VIOLATION	TYPE OF ACTION
Midvale/Thatcher Eureka, MT	01-02-87	P.W.S.	P.& S. V. T.S.S.V.	Civil Comp.[1]
Yellowstone/Summers Bro. West Yellowstone, MT	05-19-87	P.W.S.	P.& S. V., Mcl.V. T.S.S.V.	Civil Comp.[1]
Town of Neihart MT	06-08-87	Municipality P.W.S.	Multiple	Civil Comp.[1]
Allomont/Chapieski Lolo, MT	12-14-87	P.W.S.	F.T.M. - N.C.O.	Civil Comp.*
Ingomar Water Dist. Ingomar, MT	12-03-87	P.W.S.	F.T.M.	Civil Comp.[1]
Somers Water Dist. Somers, MT	12-03-87	P.W.S.	F.T.M.	Civil Comp.[1]

1 = Pending resolution
* = Settled
A.O = Any formal administrative order taken to achieve compliance
Civil Comp = Any formal action initiated through petition of the District Court
F.T.M. = Failure to monitor
Mcl. V. = Maximum contaminant level violation
N.C.O. = No certified operator
P.& S.V. = Plans and specifications violation
P.W.S. = Public water supply
T.S.S.V. = Ten States Standards violation

In a third similar case, the Department filed a motion for enforcement of a previous court order, and was successful in urging the court to order the Defendant, public water supply owner, to prepay the cost of one year's bacteriological quality sample analysis at a local laboratory, as an incentive toward regular bacteriological quality monitoring. This action is not included in the preceeding summaries because it was accomplished in the form of a motion in a situation where the court retained continuing jurisdiction from a previous civil complaint.

6.2 Nonpoint Source Control Programs

The State of Montana Section 319 nonpoint source management plan describes:

1. The process, including intergovernmental coordination and public participation, for identifying best management practices and measures to control each category and subcategory of nonpoint sources and, where appropriate, particular nonpoint sources identified in the assessment report, and to reduce, to the maximum extent practicable, the level of pollution resulting from such category, subcategory or source; and

2. State and local programs for controlling pollution added from nonpoint sources to, and improving the quality of, state waters listed in the assessment report, including but not limited to those programs which are receiving federal assistance.

Several copies of the Montana nonpoint source management plan were transmitted to EPA on August 4, 1988.

6.3 Ground Water Protection Program

6.3.1 Introduction

The Montana Board of Health and Environmental Sciences, on October 29, 1982, promulgated rules which are entitled the Montana Ground Water Pollution Control System (MGWPCS). These ground water regulations are administered by the Department of Health and Environmental Sciences (DHES), Water Quality Bureau (WQB). The regulations include a ground water classification system, ground water quality standards, a nondegradation policy and a permit program. The regulations also provide DHES with emergency powers to protect the quality of existing and future beneficial uses of ground water from spills or unanticipated discharges.

6.3.2 MGWPCS Regulations

Montana ground water regulations establish a ground water classification system and ground water quality standards to protect the existing and future beneficial uses of ground water. The classification system and standards are based on existing quality or actual use as of October 29, 1982, whichever places the ground water in the highest class. Areal mapping and classification of aquifers in Montana have not occurred.

The rules contain a nondegradation policy that states: "Any ground water whose existing quality is higher than the established ground water quality standards for its classification must be maintained at that high quality." No degradation may

occur unless it has been demonstrated to the Board of Health and Environmental Sciences that a change is justifiable as a result of necessary economic or social development and will not preclude present or anticipated use of such waters. A formal petition procedure is available whereby applicants may petition the Board for a variance from the nondegradation requirement. Changes in ground water quality resulting from nonpoint source pollutants from lands or operations where all reasonable land, soil and water conservation practices have been applied do not constitute degradation.

The emergency powers grant DHES the authority to require the person responsible for a spill or accidental discharge to take immediate measures to remediate ground water pollution problems, monitor existing or potential impacts and provide alternate supplies to existing ground water users disrupted by the release.

6.3.3 MGWPCS Permit Program

The MGWPCS permit program addresses the protection of ground water from existing or potential sources of pollution. Activities or operations which require a permit from another agency, such as hazardous waste management facilities that obtain hazardous waste treatment, storage or disposal permits or hard rock mining and milling facilities subject to operating permit requirements, are excluded from the MGWPCS permitting process. Most of the approximately 40 existing MGWPCS permit sites are gold leach operations or industrial nonhazardous waste storage and disposal facilities. Operations that were in existence prior to October 29, 1982, are not required to obtain a permit; however, ground water quality standards must still be maintained at these sites.

The typical MGWPCS permit review process includes an inspection of the site to familiarize the permit writer with the installation and the site hydrogeology. A determination of application completeness is presented to the applicant based on the review of site specific information and data provided with the permit application. Final ground water monitoring requirements are specified in the MGWPCS permit. The permit writer utilizes existing United States Environmental Protection Agency (USEPA) guidance to aid in the determination of what constitutes an appropriate monitoring system. At sites where ground water monitoring is impractical, secondary containment and leak detection/collection systems may be required.

6.3.4 Coordination with other State Programs

MGWPCS rules do not require additional permitting for potential sources of ground water pollution that are reviewed and approved and/or permitted under other regulatory programs. The

MGWPCS regulations require compliance with the state's ground water quality standards. This results in reviews by the WQB of many projects regulated by other agencies which are excluded from MGWPCS permitting requirements. Compliance with ground water quality standards is then addressed within the other agency's permit or approval process. Examples of joint review projects are Major Facility Siting Act (MFSA) projects under the Department of Natural Resources and Conservation (DNRC), mining and milling operations subject to operating permits from the Department of State Lands (DSL), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) activities reviewed by the DHES Solid and Hazardous Waste Bureau (SHWB) and subdivision or other public and private waste treatment systems approved by the WQB.

Formalization of the joint review process has been accomplished in at least two areas; first, through a Memorandum of Agreement signed between DSL and DHES addressing review of mining and milling projects; and second, by the revision of the MFSA regulations to incorporate the MFSA project joint review process by DNRC and DHES.

Management of regulated wastes in Montana is conducted by the SHWB under the Montana Solid Waste Management Act (MCA 75-10-201) and the Montana Hazardous Waste Act (MHWA) (MCA 75-10-401). Most, if not all, waste management sites have the potential to contaminate ground water. Hazardous waste treatment, storage and disposal facilities are regulated under the MHWA and are subject to regulations that are somewhat more stringent than the MGWPCS. Permits for hazardous waste treatment, storage or disposal facilities are handled almost entirely by SHWB staff. The WQB participates in the review and oversight of all CERCLA activities administered by SHWB or USEPA. The WQB is also involved in the discovery, investigation and evaluation of sites where hazardous materials have been spilled or improperly managed and threaten ground water quality.

The Montana Department of Agriculture (MDA) for the past few years has surveyed ground water quality at several locations where mismanagement of pesticides has been documented or suspected. If beneficial uses of ground water have been impacted by the improper handling of pesticides, WQB assists MDA to ensure that appropriate remedial actions are accomplished. Corrective actions or compliance plans to maintain ground water quality standards are usually administered by WQB in situations where pesticides have contaminated ground water.

6.4 Surface Water Monitoring Program

Monitoring provides basic information for a number of water quality management functions. Among them are the setting of stream classifications, establishing and enforcing water

quality standards, evaluating impairment of beneficial uses, detecting trends, determining wastewater treatment requirements, allocating waste loads, arranging problems in order of priority for cleanup action, and assessing the water quality improvements realized from cleanup action.

This section describes ambient (instream or inlake) monitoring conducted or supported by the Department of Health and Environmental Sciences (DHES). The DHES also conducts or oversees several other types of monitoring which are not discussed here. These include 1) ground water monitoring, 2) monitoring in response to complaints, 3) monitoring to check compliance with limits set for permitted discharges, 4) monitoring of public water supplies, and 5) self-monitoring of municipal and industrial effluents. Many private entities and other public agencies at all levels of government also perform ambient water quality monitoring in Montana.

The DHES surface water monitoring program continues to focus on priority waterbodies and priority basins. Short-term, intensive and synoptic surveys are emphasized rather than long-term, fixed-station and fixed-frequency monitoring. The DHES conducts the latter type of monitoring only on the Clark Fork River. A total of 3,016 Montana stream miles is assessed by regular and repeated sampling by DHES and USGS for chemical and biological information. This is abut 15 percent of the total number of stream miles in the state that have been assessed for biological and (or) chemical water quality parameters (19,505 miles).

Biological sampling (for periphyton and macroinvertebrates) by DHES has been included in monitoring programs on the Clark Fork River, on Ashley, Stanley and Lake creeks, and in four "before-and-after" studies of streams receiving wastewater from upgraded sewage treatment plants. The DHES now has the capability to perform chronic, life-cycle bioassays using the crustacean Ceriodaphnia, also known as the "water flea."

Quality assurance and data management are two critical support programs for DHES water quality monitoring. All water quality monitoring performed by the DHES conforms to U.S. Environmental Protection Agency (EPA) quality assurance guidelines, and all data so generated are incorporated into the Water Quality Bureau's data management system and entered periodically into EPA's STORET. As resources allow, DHES personnel are working to develop a computerized data storage and retrieval system for biological data to interface with the existing system for chemical and physical data.

The following sections describe fixed-station monitoring and major intensive surveys conducted by the DHES

during 1986 and 1987. The DHES has also performed a number of smaller intensive surveys over the past two years as well as toxic algae reconnaissance on Canyon Ferry and Hebgen Reservoirs.

6.4.1 Clark Fork River Basin Monitoring Project

6.4.1.1 Background

The Clark Fork is Montana's most studied, most discussed and most controversial river. It is also Montana's largest river and perhaps one of its most abused. Beginning as a small stream at the confluence of Silver Bow and Warm Springs Creeks in the Deer Lodge Valley, the Clark Fork rapidly gains size and volume from the inflows of numerous tributaries in its 20,000 square mile drainage area. Its average discharge at the Montana-Idaho border is 22,360 cubic feet per second (cfs), with flows as high as 153,000 cfs having been recorded. Just across the Idaho border, the river provides the majority of inflow to Lake Pend Oreille, a very deep and scenic natural lake that is a popular recreation area.

More than a century of mining and smelting, agriculture and timber harvesting, hydropower development and population growth have impacted the Clark Fork in Montana. Heavy metals, sediment and nutrient pollution have long been problems in the upper river. The consequences have been impaired fisheries, excessive developments of river algae, and a contaminated public water supply.

In the middle Clark Fork from Missoula to the Flathead River confluence, water quality is much improved. However, the more subtle effects of municipal and industrial wastewater discharges to this reach of the river have given cause for concern. The river here is enriched with nutrients and dissolved oxygen levels occasionally fall below state standards. Trout population densities fall short of the river's suspected potential and aesthetics problems reduce the river's recreational appeal.

The lower Clark Fork, from the Flathead River to the Idaho border, contains water of excellent chemical quality. Nonetheless, problems exist and center around a series of hydroelectric dams which have altered natural streamflows and degraded fisheries. The proposed development of metals mines in the lower river basin has also caused considerable debate because many of the tributaries there lack natural buffering capacity and are particularly susceptible to metals toxicity problems.

In Idaho, there is concern that the rate of nutrient loading from the Clark Fork to Lake Pend Oreille may be too high to protect its current trophic status.

Throughout the Clark Fork Basin, there is a high degree of public concern for water quality issues and a strong desire to preserve and enhance the river's resource potential. Pollution abatement activities over the last two decades have markedly improved water quality in the Clark Fork and there is a growing interest in continuing this trend.

In the 1986 report on Montana Water Quality, we described numerous proposed or ongoing activities aimed at correcting the Clark Fork's pollution problems. We also discussed recent activities in the basin that posed possible threats to the improvements in water quality that have been achieved and described our plan to continuously monitor the river from its headwaters to Idaho. An update on that monitoring project follows.

6.4.1.2 Monitoring Approach

In late 1985, the Montana Water Quality Bureau established a basin-wide, fixed-station water quality monitoring project on the Clark Fork River. The project was designed to 1) characterize long-term trends in water quality and document changes that might result from development activities and reclamation and pollution control efforts; 2) detect violations of ambient water quality standards; 3) monitor the biological health of the river; and 4) supplement the existing data base for water quality management decisions, such as the issuance or reissuance of wastewater discharge permits.

The current monitoring network consists of 32 mainstem, tributary and effluent stations in the Clark Fork Basin beginning in the headwaters at Butte and continuing downstream to below Cabinet Gorge Dam in Idaho (Figure 6-1). The monitoring approach consists of water quality data collection approximately 16 times a year (monthly from August through March, twice monthly from April through July) at each station. Parameters analyzed include total recoverable metals (copper, zinc and arsenic), algal nutrients (total and dissolved nitrogen and phosphorus), total and organic suspended sediment, common ions (calcium, magnesium, alkalinity, pH) and streamflow and water temperature. Once each year (August), biological samples consisting of four modified Hess quantitative macroinvertebrate (stream insect) samples and one periphyton (algae) composite sample are collected at each river and tributary station. Diel sampling of temperature and dissolved oxygen is conducted at selected stations during July or August.

6.4.1.3 Study Product

Data from the project are being compiled and entered onto the DHES management file and the EPA STORET data file. A computerized spreadsheet data analysis system has been developed to facilitate the assessment of water quality trends by sample site. The data base is growing rapidly and three years of comprehensive water quality data for the entire Clark Fork are now available.

A completion report and final data summary on the state FY87 monitoring results was prepared in the fall of 1987. Currently, we are in the process of collectively evaluating data for FY's 1985-1987. That assessment should provide a sound basis for comparison of subsequent year's monitoring results.

It is anticipated that increasing computer automation of the data base will be necessary to maximize the use of the information. It is our goal to develop an efficient and effective means of assessing the health of the entire Clark Fork on a year to year basis.

The Clark Fork data base is also proving to be extremely useful on a day-to-day basis for water quality management decisions in the Clark Fork Basin. Some recent uses include:

1. Data for the Clark Fork near Missoula were used to assess the effects of the Missoula municipal wastewater discharge on the Clark Fork and to prepare a preliminary environmental review (PER) on the facility prior to renewal of its MPDES discharge permit.
2. Data for the lower Clark Fork near Noxon are being used as baseline data for the preparation of an EIS on ASARCO's proposed Rock Creek Mine and to establish discharge permit limitations for a mine water discharge from that facility.
3. Data for Silver Bow Creek and the upper Clark Fork were recently assessed in a review and proposed modification of the current water quality standards established for those stream reaches.
4. Data for Warm Springs Creek were examined to assess the consequences of a proposal by the City of Anaconda to reroute its municipal sewage discharge from a series of tailings ponds to the creek.
5. Data assessments for the Clark Fork from its headwaters to below Missoula are being utilized in the preparation by the Montana Department of Natural Resources of an EIS on the state's application for reservation of instream flows in the upper Clark Fork.

6. Data for Silver Bow Creek above and below the Warm Springs treatment ponds are being used by the Superfund Program to supplement their existing data base in their evaluation of the pond system.
7. Clark Fork nutrient data are being used in a current EPA Clark Fork nutrient/algae study. An objective of the study is to establish nutrient criteria for the control of nuisance algae growth in the river.
8. The data will be used to evaluate the environmental impact of a proposed mine development by Pegasus Gold Corporation in German Gulch, a tributary to Silver Bow Creek.
9. Lastly, the data are being used by the Governor's office, DHES and others in the development of a status report and action plan for the entire Clark Fork Basin.

Given the multitude of development and pollution control activities foreseen in the basin and growing public interest in improving water quality, the need for continued vigilance through a comprehensive monitoring program is critically important. The ongoing data collection together with the baseline information now established will allow the documentation of trends, the evaluation of pollution abatement activities and the identification of new problems.

6.4.1.4 Funding

The Clark Fork Basin Water Quality Monitoring Project was initiated in late 1985 using EPA funds. The 1985 Montana legislature authorized funding of the program in state FY87 through a Resource Indemnity Trust (RIT) program grant, which is interest money from a tax on extracted minerals. A continuation of RIT funding (through the Reclamation and Development Grant Program) through FY's 88-89 was approved by the 1987 legislature. Because the intent of the RDGP is not to fund long-term monitoring projects, the DHES is exploring alternative sources of funding for fiscal years 90-91. Given the level of public and agency interest in the Clark Fork's problems, the prospects for continuing some form of long-term monitoring program on the river seem excellent.

6.4.1.5 Other Studies

Section 525 of the 1987 federal Water Quality Act (Clean Water Act amendments) directs EPA to assess sources of pollution in Lake Pend Oreille, the Clark Fork River and its tributaries in Idaho, Montana and Washington. Congress has appropriated $300,000 for the first year of this assessment, and an interstate and interagency "steering committee" of water quality professionals has prepared a comprehensive plan to determine the sources and assess the impacts of nutrients in this aquatic ecosystem. This plan was submitted for funding on

September 15, 1987 to the EPA Office of Research and Development and the EPA Office of Water Programs.

On October 26, 1987, the Montana Department of Health and Environmental Sciences awarded a $100,000 study grant to the University of Montana to help determine the cause of nuisance algae growths in the Clark Fork River.

The Department's Water Quality Bureau will use results of the study to determine whether it will be feasible to reduce algae levels in the river by limiting the discharge of nutrients or by controlling other factors that promote algal growth.

The study will be directed by Dr. Vicki Watson, Associate Professor of Botany at the University. Dr. Max Bothwell, Chief of Aquatic Ecology Division, National Hydrology Research Institute, Saskatoon, Saskatchewan, will serve as special consultant to the study.

Researchers will analyze samples of algae collected from several river locations and conduct fertilization experiments in artificial streams that have been constructed at the Missoula Wastewater Treatment Plant. Dr. Watson will develop a model to predict algal growth based on nutrient concentrations and other variables.

Funds for the study were provided by Region VIII of the U.S. Environmental Protection Agency for the purpose of assessing water quality problems in the Clark Fork River other than those caused by heavy metals. The Water Quality Bureau will supply necessary river nutrient data to the study through the Clark Fork Basin Monitoring Project. The study will run through December 1988.

This study will be an integral part of the overall assessment called for by Section 525 of the 1987 federal Water Quality Act.

6.4.2 Flathead Lake Monitoring

Evidence of cultural eutrophication in Flathead Lake has prompted more intensive and extensive water quality monitoring in the Flathead Basin.

Beginning July 15, 1984, the DHES contracted with the University of Montana Biological Station on Flathead Lake to monitor the amounts of algal nutrients entering and leaving the lake and the amount of algal growth in the lake itself.

In January 1985, supported by a $10,000 grant from the Flathead Basin Commission, Dr. Jack Stanford of the University of Montana Biological Station prepared a Master Plan for monitoring the quality of surface waters in the Flathead Basin. [1]

At the core of the Master Plan is an effort to measure the phosphorus budget and the eutrophication status of Flathead Lake. The DHES share of this effort is $30,000 a year, which funds collection of data at six tributary stations and one mid-lake station. This information will be used to evaluate progress under the Flathead Lake Phosphorus Strategy and to make adjustments as necessary to achieve desired water quality goals. A 1988 annual report on monitoring results has been prepared.

6.4.3 WWTP Upgrade Studies

The 1986-87 biennium saw the completion of studies on three streams that focused on the principal municipal wastewater treatment plant (WWTP) discharge received by each stream. The purpose of these studies, which were on the Bitterroot River (Hamilton WWTP), Hot Springs Creek (Hot Springs WWTP), and Big Spring Creek (Lewistown WWTP), was to document improvements to instream water quality resulting from the upgrading of 1950's vintage wastewater treatment facilities under the Construction Grants Program.

The initial phase of each study involved the collection of physical, chemical and biological data from several stream sites on three occasions during 1983, before the treatment facilities were upgraded.

Construction of new treatment works was completed between 1984 and 1986 at each of the communities, and a shakedown period of 12-18 months preceded the start of the "after" survey. This permitted plant operations to stabilize, and allowed the aquatic environment of downstream reaches to adjust to changes in water quality.

The final phase of each study duplicated the initial monitoring, which permitted meaningful comparisons of data from before and after the treatment plant upgrades. Final reports are expected by December, 1988.

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1 Stanford, J.A. January 1985. Monitoring Surface Water Quality in the Flathead Basin: Master Plan. Open File Report, Flathead Lake Biological Station, University of Montana, Bigfork. 23 pp.

6.4.4 Bioassays

At the present time, the DHES does not have a program to specifically identify and characterize toxic pollutant problems. Fortunately, Montana does not have the dense population and heavy industry often associated with numerous and severe toxics problems in other states. Relatively few miles of rivers and streams are impacted by more than a single wastewater discharge. Therefore, additive, cumulative, or synergistic effects of multiple discharges are not significant concerns. Streams which have been severely degraded by historic mining activities probably account for most of the state's toxic pollutant problems.

Montana's toxicity testing program includes the use of the cladoceran Ceriodaphnia, recommended by the USEPA for testing ambient waters and wastewater discharges. Cultures of Ceriodaphnia are continuously maintained, so that bioassays can be conducted when necessary. Bioassays have been used to screen wastewater treatment plant effluents for toxicity, to determine whether heavy metals from nonpoint sources were degrading water quality downstream of a copper-silver mine and mill complex, and to evaluate the toxicity of sediments and heavy metals released during a drawdown of Milltown Reservoir near Missoula.

In August, 1986 seven discharges to the Yellowstone River near Billings and river water from locations upstream and downstream of these discharges were screened for toxicity. This segment of the Yellowstone River probably receives more wastewater and potentially toxic discharges than any other stream in the state. In June, 1987 DHES assisted USEPA with a bioassay of the Missoula WWTP discharge. Ceriodaphnia, fathead minnows, and rainbow trout were tested to define toxicity limits for the renewed discharge permit.

The Ceriodaphnia bioassay has become a useful technique to complement other components of the surface water monitoring program. It will probably be used more frequently as Montana's biomonitoring program progresses and more discharge permits containing biomonitoring requirements are issued.

6.5 Special Programs

6.5.1 Flathead Basin Commission

The five-year Flathead River Basin Environmental Impact Study funded by EPA and completed in 1983, left no doubt that water quality in the Flathead River Basin is deteriorating at an accelerating rate. Slowing this transformation requires pinpointing pollution sources, weighing the trade-offs involved

in ending pollution and coordinating the many agencies that share jurisdiction over important development-related decisions in the basin.

In response to public support, the 1983 Montana Legislature established the Flathead Basin Commission to "protect the existing high quality of the Flathead Lake aquatic environment; the waters that flow into, out of, or are tributary to the lake; and the natural resources and environment of the Flathead basin."

The commission is comprised of members from federal, state, local and tribal agencies, as well as private interests, and is charged with: 1) monitoring the basin's natural resources, 2) encouraging cooperation among basin land managers, 3) holding public hearings on the condition of the basin, 4) supporting economic development without compromising the basin's aquatic system, 5) promoting cooperation between Montana and British Columbia on resource development in the Flathead basin and 6) making recommendations to the legislature regarding the preservation of the basin's aquatic resources.

To meet its challenges, the commission calls on technical experts and land managers from state, federal, tribal, and local agencies and scientists from the university system. Examples of recent actions by the commission include its successful lobbying effort for legislation that allows local governments to restrict the sale and distribution of phosphate detergents (Chapter 75, Title 7, Section 401 et seq. MCA), and its recommendation to the state's DHES to require phosphorus removal at municipal wastewater treatment plants discharging to Flathead Lake or its tributaries.

The commission has also been instrumental in establishing and seeking funding for a Water Quality Monitoring Master Plan in the basin, the first of its kind. This Master Plan integrates water quality monitoring by area agencies, the Montana university system, and private land owners. It will provide a comprehensive assessment of changes in water quality, as well as identify the probable reasons for any changes.

The commission is required to submit a biennial report to the governor and the appropriate committees of the legislature, and to make recommendations appropriate for fulfillment of its duties. The first biennial report was issued in October, 1985. Through a discussion of the many issues in the report, the commission emphasized the need to coordinate agency regulations regarding water quality, and for all regulatory parties to interact frequently. The report also noted that citizens should be allowed to question agency officials who sit on the commission about the agency's use of authority in water quality-related decisions. The commission, by means of public

meetings and hearings, actively pursues and solicits public opinion regarding Flathead Lake and the quality of water in the basin.

Water quality monitoring and adequate funding to implement the Master Plan continue to be the first priorities. The commission is active in supporting agency budget requests for water quality monitoring programs, as well as exploring other sources of funding for these activities.

The Freshwater Foundation is a Minnesota based, non-profit organization which has supported fresh water research and public information programs since 1968. The commission recently began working with the Freshwater Foundation to develop an integrated public education program regarding the water quality problems facing Flathead Lake and other water bodies in the basin. The Flathead Basin Commission and the Freshwater Foundation recognize that the water problems facing the Flathead are social, economic and political in nature. Now that the key parameters of the basin's problems have been scientifically described, the implementation of solutions is the next step. Such implementation will require enhanced public understanding of the problem if it is to be accepted. Using Freshwater Foundation support, the commission has hired a program manager whose duties include assisting in the development of a speakers bureau, slide shows, breakfast meetings and various seminars and conferences on water quality.

6.5.2 Clark Fork River Basin Project

The Clark Fork River Basin Project is a special program initiated by the Montana Governor's Office to coordinate water-related investigations in the Clark Fork River basin. The principal objective of the project has been to provide continuity to past, current and planned studies within the basin and to identify where additional information is most urgently needed. The Clark Fork River Basin Project has been guided by an interagency task force that includes representation from the State of Idaho and Regions 8 and 10 of the Environmental Protection Agency.

Since the project's inception in 1984, many different investigations have contributed new knowledge about sources of pollutants and their impacts on the basin's aquatic resources. These studies have been concerned with pulp and paper mill wastes, municipal waste discharges, new mining ventures and Superfund projects. Special investigations have focused on water reservations, ground water inventory, water quality monitoring and streambank reclamation. New efforts have been initiated to define the distribution and abundance of fish and other biological communities in the Clark Fork River and tributaries. A coordinated study is underway to define sources of nutrients

and the extent of nuisance algae growth in the mainstem Clark Fork River and in Lake Pend Oreille.

Throughout the basin, the public has demonstrated a strong interest in maintaining and improving water quality. Public participation and awareness has been promoted by active, well-organized citizen interest groups. This continued and growing public interest offers the Clark Fork River Basin Project an excellent opportunity to involve citizens in the identification and selection of alternatives for managing the basin's resources.

The Clark Fork River Basin Project will be concluded in 1988 with the publication of a status report and management plan. The plan is being prepared with the technical assistance of an interagency task force and eight working groups of state, federal and university scientists. The report will summarize existing information on water uses including benefits and costs; water rights and their implications for water use; future water needs; and environmental issues in the basin. The action plan will focus on specific issues, alternatives for management and recommended actions. Public participation in the development of the report will be encouraged and a draft report/plan will be provided for public review and comment. Public meetings will be held in several communities to obtain public comment.

6.6 Drinking Water Program

6.6.1 Ground Water Problems

Ground water provides water for more than 95 percent of Montana's public water supplies (PWS), but these sources serve only about 30 percent of the people who use public systems. Ground water systems have resulted in few health-related problems. Eight community systems exceed the maximum contaminant levels (MCL) for fluoride and nitrate, and two exceed the MCL for selenium. Of lesser significance are those waters that are safe to drink, but have taste and odor problems. Many of the ground water sources east of the Rocky Mountains have aesthetic problems associated with one or more of the following: dissolved solids, iron and iron bacteria, manganese, hydrogen sulfide gas, sodium and sulfate. In some areas the ground water quality is so poor, farms have to haul water or, with the aid of loans and grants, build extensive rural water systems.

Generally, Montana's ground water is not particularly vulnerable to bacterial contamination although some shallow aquifers are exceptions to this generalization. Some of these sources already require chlorination and each year, due to unsatisfactory sample results, a few more systems install full time disinfection to ensure safe drinking water. The potential for contamination may be increasing with the decline of water

tables caused by drought and the contamination of aquifers by petroleum products and pesticides.

6.6.2 Surface Water Problems

Only about four percent of Montana's PWS use surface water. However, these systems provide water to about 70 percent of the people who receive water from public systems. The major concern is that many supplies have no treatment other than chlorination. This leads to violations of the MCL for turbidity and occasionally to serious health problems. Over the past ten years several Montana communities have reported cases of giardiasis, including White Sulphur Springs, Red Lodge and Missoula. Missoula was forced to abandon its Rattlesnake Creek water supply due to an outbreak of giardiasis, and Red Lodge installed a new filtration plant to prevent the recurrence of an epidemic that affected 860 people in the summer of 1980.

Giardiasis is caused by the parasite _Giardia lamblia_. _Giardia_ inhabits the small intestine of humans and other animals, and causes symptoms such as diarrhea, weakness, weight loss, nausea and abdominal cramping. It is transmitted by an individual ingesting the cyst, or dormant stage of the organism. It has become the most commonly detected cause of waterborne gastroenteritis in the United States. Cysts occur in water when infected animals excrete fecal material into lakes and streams. Several million cysts may be released at once, but as few as 10 are able to cause an infection in humans. Because _Giardia_ cysts are resistant to chlorine and have been found to be viable in drinking water which meets coliform and turbidity requirements, the DHES has taken a close look at the statewide potential for _Giardia_ problems. Each surface water system has been assessed individually to be sure treatment is in place that is capable of inactivating and/or removing _Giardia_ cysts. Surface water systems that are deemed by the department to be "at risk" are ordered to issue a Health Advisory to their users. This advises the users of the risks associated with the system's water. Information on the parasite is also provided to water system operators, local government officials, local health department employees and the general public to help eliminate misinformation and to educate the public about this important resident of our surface waters. This program, piloted by the Montana Public Water Supply Program, has been very successful and is now being copied by other states.

Tastes and odors associated with algae blooms pose problems for many surface water systems. Several communities have sought to alleviate these problems and other health related concerns by building treatment plants or switching to ground water. Bozeman recently put in a new 10-million-gallon-per-day direct filtration plant. Red Lodge built a new water plant, as

have Devon, Loma, Culbertson and Fort Peck. Helena has improved and expanded its Missouri River plant and is currently under a depatment order to construct a new facility on the Ten Mile Creek system. Also many non-community supplies have either abandoned their surface sources, replacing them with ground water sources, or have added filtration and full time disinfection.

6.6.3 Public Water Supply Program

The DHES has been given responsibility by the U.S. Environmental Protection Agency (EPA) for the administration of the Safe Drinking Water Act. The Public Water Supply Program regulates about 2329 public water supplies (PWS) of which approximately 725 are community systems. One of the most important aspects of the program is to insure that all public water systems are monitored on a regular basis for bacteriological, radiological, chemical and physical contaminants. The results of this monitoring are then reviewed to be sure that the water served to Montana's public is reasonably safe for human consumption. Also, the DHES conducts sanitary surveys of all PWS on a regular basis. The findings of the sanitary surveys are used to see that necessary improvements are made to existing systems to reduce or eliminate any public health hazards that are discovered.

Montana law also requires the department to review plans and specifications for all construction proposed for both PWS and public sewer systems. This takes up considerable staff time. The DHES has incorporated the "Ten States Standards" as part of the Montana rules. They are used as minimum design standards for community systems. The department has written its own design standards for noncommunity systems.

Montana's Public Water Supply Program has changed markedly since receiving primacy from EPA in 1977. The program now regulates and monitors about seven times as many PWS as it did ten years ago. Funding for the program has not kept up with the steadily increasing responsibilities, and over the past few years there have been cutbacks in staff. This means the program has to accomplish more with fewer resources. The 1986 Amendments to the Safe Drinking Water Act and the new regulations mandated by those amendments exacerbate this problem. Over the past couple years the Water Quality Bureau has purchased a networking system of IBM Personal Computers. The Public Water Supply Program has made very good use of these and the PCs have made the program much more efficient and productive. The system started with six computers, two printers, standard word processing and spread sheet software and a networking data base called "Revelation". It now has several more PCs, new printers and is constantly being upgraded as the bureau recognizes new uses for the system.

Program staff interact daily with public and private water system personnel as well as with the press and concerned public to help solve a wide array of problems. These problems include system contamination, equipment failure, floods, taste and odor complaints, operator training needs and proposed construction on new and existing systems.

Over the past few years more emphasis has been placed, by both EPA and the state, on enforcement actions against systems that are found to be persistent violators of the regulations. A number of PWS have been taken to court to seek compliance with state and federal requirements. The enforcement actions have been vigorously pursued by the department, which has been nearly 100 percent successful in achieving compliance by the targeted systems. EPA Region VIII has recognized the Montana Public Water Supply Program as a leader in the area of enforcement. The program's legal support has recently been reinforced by additions to the department's legal unit and it is expected that this will enable the Program to make even greater strides in the enforcement area.

7. RECOMMENDATIONS

To accomplish the objectives of Montana's proposed nonpoint source control program, private landowners, and local, state and federal management agencies must develop a high level of cooperation. Emphasis should be placed on achieving the objectives of the Clean Water Act. To accomplish these objectives, the State Water Management Agency (DHES) must have a solid commitment from the private sector and other state and federal agencies.

Specific recommendations are as follows: the Soil Conservation Service needs to continue or increase their emphasis on water quality programs and to establish new techniques for stream corridor management. The Local Conservation Districts, should evaluate and update their water quality plans; the Agriculture Stabilization and Conservation Service should continue to cost share programs that address water quality issues; the county ASC committees should consider cost share on newly developed soil and water conservation practices and streambank stabilization techniques; the Extension Service should increase their efforts on educational programs; federal land management agencies such as the Forest Service and Bureau of Land Management should coordinate and cooperate on state and/or local water quality problems; the Department of Natural Resources should continue their cooperative efforts in resolving agricultural nonpoint source pollution; the private sector must increase its awareness of water quality issues and work with the agencies on water quality problems.

Finally, Congress and the Executive Branch in Washington, D.C. must get serious about funding nonpoint source pollution control needs identified by the states and federal resource management agencies.